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Notes on a Collection of Crabs from Christmas Island, Indian Ocean

By MELBOURNE WARD F. Z. S. HON. ZOOLOGIST, AUSTRALIAN MUSEUM, SYDNEY

PLATES I—III

This interesting collection was made by Mr. M. W. F. Tweedie, Assistant Curator of the Raffles Museum, Singapore, and includes a number of new species, two of which belong to new genera described in the following pages. I am deeply indebted to Mr. Tweedie for the opportunity of working on the material and take pleasure in naming one of the new genera after him. Two species of the neglected genus *Pilumnus* have been omitted from this report in order that they may receive further attention, and will be finally included in a study of the Australian forms.¹

The types of the new species will be deposited in the British Museum.

SYSTEMATIC.—

Hyastenus macrospinosis sp. nov.

Prochinococcus sculptus gen. and sp. nov.

Kraussia proporellana sp. nov.

Pseudolionura natalensis sp. nov.

Atergatis tweediei sp. nov.

Leptodius planus sp. nov.

Etisodes albus sp. nov.

Medacus noctensis sp. nov.

Paraxanthius haemalostictus sp. nov.

Chlorodopsis natalensis sp. nov.

Tweedieia noctensis gen. and sp. nov.

Percnon demani nom. nov. for

Leiopholus abbreviatus de Man (nec Dana.).

Pachygrapsus natalensis sp. nov.

Order DECAPODA

Tribe Brachyura

Sub-tribe Dromiacæa

Family DROMIIDÆ

Genus *Cryptodromiopsis* Borradaile

Cryptodromiopsis Borradaile Ann. Mag. Nat. Hist. (7), 11, no. LXIII, Mar. 1903. 299.

Haplotype. *C. tridens* Borradaile 1903. Type locality. Male or Minikoi Atolls.

1. Thanks are due to Dr. Charles Anderson, the Director of the Australian Museum, for allowing Joyce K. Allan to make the accompanying drawings.

Cryptodromiopsis tridens Borradaile.

Cryptodromiopsis tridens Borradaile Ann. Mag. Nat. Hist. (7), 11 no. LXIII, March 1903. 300. Described more fully Fauna and Geog. Maldivian and Laccadive Arch., II, 1906, 578, pl. XXXIII, fig. 4. Male and Minikoi Atolls.

Material.—One male measuring 8 mm., across the carapace.

Sub-tribe **Brachygnatha**

Superfamily **Oxyrhyncha**

Family **MAIIDAE**

Genus **Hyastenus**, White

Hyastenus White, Proc. Zool. Soc. London XV (172) May. 1847. 56.
Haplotype. *Hyastenus sebae* White.

Hyastenus macrospinosis sp. nov. Pl. 1, Fig. 4, 4a.

Carapace moderately convex transversely, the cardiac and gastric areas are outlined by shallow sulci which are in the form of a lyre. There is a reversed triangle on the cardiac region formed by three low granules. There are two kinds of hair on the carapace; the most noticeable consists of short stiff black bristles, the tips of which are slightly curved, the other hairs are long and golden. The epibranchial spine is represented by a small blunt nodule and there is a row of smaller nodules extending along the epimeral wall of the carapace a short distance above the bases of the ambulatory legs. The sub-hepatic facet is not strongly developed and is capped by a nodule similar in shape to those on the epimeral wall.

The orbit is large and the eye is received unto a broad cupped tooth the supra-ocular eave is developed into a strong acclivous spine anteriorly. The space between it and the post-ocular tooth is filled by a small blunt spine, the margins of which are fused with the supra-ocular eave and the post-ocular tooth.

The rostral spines are slender and short, being about half the length of the carapace.

The ambulatory legs are thick, the merus of the first pair is armed along its anterior margin with a series of sharp spines ending near the extremity with a long spine. There is a similar one on the carpus and both are directed forward. The other legs are unarmed.

The sternal surface is covered with a coating of short yellow down.

Material.—One male measuring 10 mm., total length of the carapace, including rostral spines. Designated as Holotype.

One female measuring 10 mm. retained in Ward collection, Sydney.

Family PARTHENOPIDÆ

Sub-family EUMEDONINÆ

Genus *Proechinoecus* nov.

The carapace is pentagonal and scarcely convex in a longitudinal direction. The rostrum is broad, lamellate and rounded at the tip and without a vestige of a median emargination. The anterior legs are short and sub-equal; the ambulatory legs are slender. It is allied to *Echinoecus* Rathbun but is readily differentiated by the following characters.

Echinoecus Rathbun.

Proechinoecus nov.,

1. Carapace very convex.	1. Carapace almost flat.
2. Rostrum triangular and flattened horizontally; strongly deflexed.	2. Rostrum broadly triangulate; concave horizontally; not strongly deflexed.
3. Eyes small, in circular orbits concealed by the carapace.	3. Eyes of normal size; not concealed by the carapace.
4. The junction of the rostrum and the anterolateral margins marked by an indentation.	4. The lateral margins and the rostral margins are broken by the orbit but the broadly triangulate outline of the carapace is retained.

^{*} *Proechinoecus* resembles *Gonatonotus* White, of which there are specimens in my collection, but it may be readily separated by the condition of the lateral angles and the postero-lateral margins of the carapace. In *Gonatonotus* White the lateral angles are produced as transversely directed acuminate processes and the postero-lateral margins are concave; in *Proechinoecus* the lateral angles are not transversely produced and the postero-lateral margins are parallel and moderately convergent posteriorly.

^{*} The antennular fossæ of *Proechinoecus* are almost longitudinal whereas they are oblique in *Gonatonotus* White.

Proechinoecus sculptus sp. nov., Pl. I, Fig. 5, 5a.

A marked degree of sexual dimorphism occurs in this species, and is not to be observed in the known species of the allied genera. It consists in the eroded condition of the carapace of the females. As noted further on in the description the surface of the carapace has the appearance of the moon's surface, being

covered with irregular shallow crater-like pits; the eyes of the females are smaller than those of the males and the dorsal surface of the carapace of the male is coarsely punctate but not eroded.

Description of the male type.—The carapace is slightly broader than long, the surface is covered with coarse punctæ. There is an intensification of the punctæ on each side of the cardiac regions which form crescent shaped areas, the horns of which point towards the lateral margins of the carapace.

The anterolateral margins of the carapace are rounded and the sub-hepatic and epimeral walls are vertical and finely eroded. The anterolateral angle of the carapace is armed with a short, sub-acute, anteriorly directed spine, the posterior margin of which is confluent with the postero-lateral margin. The postero-lateral margins are parallel and defined by a sharp margin for their anterior half; moderately convergent and undefined in the posterior half.

The orbital hiatuses are broad and filled by the antennæ. The eyes fit the orbits completely. The antennular fossæ take up most of the under surface of the rostrum and their anterior margins are not defined. The basal articles of the antennulæ are sculptured and resemble the adjacent walls of the carapace appearing to be lateral prolongations of the epistome making contact with the lateral angles of the rostrum. The epistome is narrow, transversely concave and smooth.

The buccal orifice is broad, its width being equal to half that of the carapace. The external maxillipeds are smooth and covered with scattered punctæ. The ischium of the maxilliped is longer than broad, the inner margin entire and without hairs. The merus is equal to half the length of the ischium.

The sternum is smooth and less densely punctate than the dorsal surface of the carapace. The abdomen is narrow and its margins are clothed with fine hairs which form a thick fringe on the last segment.

The chelipeds are unequal; the merus of the larger is short and armed on the upper margin with a broad blunt spine and there is a sharper and longer spine on the anterior margin near the articulation with the carpus. The carpus is strongly punctate externally and armed on the inner angle with a broad sub-acute spine. The manus is as broad as its upper margin is long; the upper and outer surfaces are punctate, the punctæ being more numerous above than below. The lower margin is thin but not cristate and the outline is convex. The immovable finger is slightly deflexed.

The dactylus is armed with broad triangulate teeth which interlock with those on the immovable finger, these teeth are

not strongly developed. The small chela resembles the large in all but size.

The ambulatory legs are long and slender, the merus of the last pair is equal to the propodus, but in the other pairs it is slightly longer.

Male type measuring 4 mm., across the carapace.

Description of the female type.—The rostrum is less produced than in the male.

The eye is smaller and the eye stalk is abruptly constricted so that the cornea is small and globular.

The dorsal surface of the carapace is covered with irregularly shaped pits some very large and others very small and giving the appearance of moon craters as previously noted. The areas on each side of the cardiac region are intensely sculptured.

The legs and chelae are less sculptured than the carapace.

The abdomen covers the whole surface of the sternum.

The dissimilarity of the sexes is comparable with the dimorphism to be observed in such genera as *Hucnia* and *Pinnotheres*.

Female type measuring 6.5 mm. across the carapace.

Material.—Numerous specimens found underneath the tests of the Echinoid, *Colobocentrotus atratus* (Linn.), a species which lives adhering tightly to the surface of rocks between tide marks.

Super-family Brachyrhyncha

Family PORTUNIDÆ

Genus *Charybdis* De Haan.

Charybdis de Haan Fauna Japonica Crust., 1833, 3, 10.

Logotype *Portunus* (*Charybdis*) *dentatus* de Haan 1833. *Cancer sexdentata* Herbst 1783, East Indies., *Portunus lucifer* Fabricius 1798 Indian Ocean.

Charybdis picta (Stimpson).

Thalamita picta Stimpson, Proc. Acad. Nat. Sci. Phila., X 1853, 39 (37) Ousima. and Smithson. Miscell. Coll. Wash., XLIX, 1907, 85, pl. X, fig. 5.

This species bears a resemblance to *Charybdis lineatum* (A. Milne Edwards) from Nukahiya, however a careful comparison of specimens in my collection with the description and figure of Milne Edwards convinces me that the species are distinct.

Material.—Ten females ranging from 8.5 mm. to 18.5 mm. in total carapace width. All but one of the mature individuals are ovigerous. The largest immature specimen is 10 mm. broad. The smallest ovigerous specimen is 12 mm. broad. Three

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specimens have the red markings on the carapace which form a broad Y on one, on another only the tips of the figure are present.

Six males ranging from 7 mm. to 18.5 mm. total carapace width. The largest specimens have the red markings on the carapace noted on the mature females.

Family CANCRIDÆ

Genus *Kraussia* Dana

Kraussia Dana, U.S. Explor. Exped., XIII, Crust, 1. 1852, 300.
Haplotype. *K. rugulosa* (Krauss) South Africa.

Kraussia proporcillana sp. nov. Pl. I, Fig. 7, 7a, 7b.

K. proporcillana differs from *K. integer* (de Haan) in the following characters:—

1. It is narrower across the posterior margins.
2. The front is narrower and the median lobes are prominent.
3. The anterolateral margins are not as marked.

From *K. nitida* Stimpson (Dredged in 20 fathoms in Kagoshima Bay.) in having the anterolateral margins armed with spines.

From *K. rugulosa* (Krauss) in having:—

1. The front more advanced in the middle.
2. The fronto-orbital margin narrower.
3. The fingers of the hand toothed on their opposed edges.
4. The ridges on the upper margin of the mobile finger not placed as in *K. rugulosa*; there are three in *K. proporcillana*, two having nodules along them, the third, which is on the inner margin, is faintly marked and without nodules.

From *K. porcellana* (Adams and White) in having:—

1. All the lateral spines simple.
2. The mobile fingers of the chelæ armed with only three teeth.
3. No denticulated lines on the external surface of the immobile fingers.

From *K. hendersoni* Rathbun in having the front less produced, the median lobes broad instead of the outer lobes as in *K. hendersoni* and the anterolateral margins armed with fine teeth.

Material.—Three males measuring 8.5, 10, and 12 mm., respectively in total carapace width. The largest is designated as type. One female measuring 10.5 mm. in total carapace width.

Family XANTHIIDÆ

Sub-family XANTHIINÆ

Genus *Carpilodes* Dana

Carpilodes Dana Amer. Jour. Sci., (2) XII, 1851, 126.

Haplotype *C. tristis* (Specific name not given until 1852). Locality. Paumotu Arch.

Carpilodes rugatus (Latreille). A. Milne Edwards.

Carpilodes rugatus (Latreille), A. Milne Edwards, Nouv. Arch. Mus. Hist. Nat. Paris. 1, 1865, 230, pl. XII, figs. 3, 3a, 3b. Indian Ocean, and coast of China.

Carpilodes rugatus. (Latreille) Ward. Austn. Zoologist VII, III, 1932, 241. Capricorn Group, Queensland.

Material.—Two females measuring 10 mm. across the carapace and three males measuring 9.5, 10.5 and 12 mm. across the carapace. The specimens all exhibit the characteristic colouration of the carapace and limbs, dark purple with the tips of the ambulatory legs white. The fingers of the chelæ are red proximally, the distal half white.

The species appears to be widely distributed, and displays very little variation when specimens from widely separated localities are compared. There are specimens in my collection from North West Island, Queensland.

Carpilodes bellus Dana.

Carpilodes bellus Dana U.S. Explor. Exped., Crust. 1. 1852, 196. Atlas, 1855, pl. XI, fig. 2.

Odhner, 1925, gives *C. vaillantianus* A.M. Edwards from the Red Sea as a synonym of *C. bellus* Dana.

Material.—Four males ranging from 6 to 9 mm. and six females ranging from 5 to 10 mm., total carapace width.

Genus *Pseudoliomera* Odhner

Pseudoliomera Odhner, K. Vet. O. Vitterh. Samh. Handlingar, Bd. 29, 1, 1925, 74.

Orthotype. *P. granosimana* (A. Milne Edwards).

Type Locality. New Caledonia.

Pseudoliomera natalensis sp. nov. (Pl. III, Fig. 2, 2a).

The carapace is broader than long, longitudinally convex. The median portion of the carapace is flat transversely curving abruptly downward near the anterolateral margins. The inter-regional sulci on the dorsal surface of the carapace are distinct, the surface is microscopically granular and coarsely punctate.

The anterolateral margins are thick and entire. The posterolateral margins are not defined; they are very short and slightly concave. The front is equal to one third of the total width of the carapace; it is deflexed and slightly emarginate.

The orbits are large and the eyes fit snugly into them. The upper orbital margin has two faint sutures close together near the lateral angle. The antennae are almost excluded from the orbits. The antennules are large and transversely directed.

The maxillipeds are large and smooth and completely close the buccal orifice. The chelipeds are equal in size and compressed. The lower outer surface is smooth and shining, the upper half is ornamented with large procurred spinose granules.

The sternum is coarsely punctate but the abdomen is smooth. The ambulatory legs are compressed but not carinated.

P. natalensis differs from *P. granosimana* (A. M. Edw.), in several characters: 1. The inter-regional sulci are distinct upon the carapace of *P. natalensis*. 2. The chelæ are equal in size in *natalensis*. 3. The granules on the outer surface of the hand of *natalensis* are salient. 4. The fingers are pale brown and much shorter than in *P. granosimana*. 5. The ambulatory legs are compressed in *natalensis*.

Material.—One male measuring 13 mm. in total carapace width; designated as type. One female measuring 12 mm. in total carapace width.

Genus *Lioxantho* Alcock

Lioxantho Alcock, Journ. Asiatic Soc. Bengal. LXVII, II, 1, 1898. 90.

Logotype. *L. tumidus* Alcock, by present designation.

Type locality. Andamans.

Lioxantho laevidorsalis (Miers). (Pl. II, Fig. 2, 2a).

Xantho laevidorsalis Miers, Challenger Brachyura, XVII, 1886, 127.

Xantho bidentatus Miers Ibid. XVII, 1886, 126; not of A.M. Edw.

The figures in the Challenger report on Brachyura are very misleading owing to their not having been checked by Miers before they were published. And consequently it is with some hesitation that I place the single specimen before me in this species.

I have specimens from Rarotonga of what I take to be *L. bidentatus* (A. Milne Edwards) which was originally recorded from Hawaii, but which has not since been noted as occurring at that locality, except that it is listed by Rathbun, 1903, apparently without further material being examined from that locality. *L. laevidorsalis* (Miers) is readily separable from *L. subacuta* (Stimpson) by the narrower outline of the carapace and by the dentition of the anterolateral margins (for which see figures).

Material.—One female measuring 11.5 mm., in total carapace width.

Lioxantho subacuta (Stimpson). (Pl. II, Fig. 1, 1a).

Liomera subacuta Stimpson. Proc. Acad. Nat. Sci. Philad., X, 1858, 32 (29) and Smith. Miscell. Coll., lxx, 1907, 39, pl. v. fig. 1. "Loo Choo".

The specimens before me agree with the description and figure quoted and also approach the description and figure of *L. subacuta* which was published by de Man and which has subsequently been called *Xantho demani* by Odhner. However there are sufficient characters which separate the two and consequently I use Stimpson's name.

Material.—One female measuring 12.5 mm., across the carapace. Two males measuring 10 and 15 mm., across the carapace.

Genus Atergatis De Haan

Atergatis de Haan Fauna Japonica Crust., 1833, 17.

Logotype. *A. intergerimus* de Haan. by present designation.

Type locality. Japan.

Atergatis tweediei sp. nov. (Pl. I, Fig. 3, 3a).

The species is allied to *A. oxyroe* (Herbst) but is readily separated by the following characters:—1. The ambulatory legs are not crested. 2. The upper margin of the hand is not carinated and there is no evidence of the net-work of raised lines characteristic of the outer surface of the hand of *A. oxyroe*. 3. The front is broader in *A. tweediei*.

Description.—The carapace is smooth and very faintly areolated, the most distinct impressed lines are those on each side of the cardiac region. The surface of the carapace is punctated all over. The anterolateral margins are thin and divided into three broad lobes by two distinct fissures.

The orbits are large and resemble those of *A. oxyroe* in shape, except that the inner angle of the lower border is not produced as far as the supra-orbital angles. The front is deflexed and slightly bilobed, the median notch is obsolete.

The chelipeds and ambulatory legs are smooth, and although they are compressed, they are not carinated. The manus has its outer surface coarsely punctate. The pollex has three large, sharp teeth on its proximal half; the dactylus is without teeth, its outer surface has a longitudinal groove.

Material.—Two females 8 and 9 mm. across the carapace.

Genus Leptodius A. Milne Edwards

Leptodius A. Milne Edwards, Ann. Sci. Nat. (4) XX, 1863, 284.

Logotype Specified by Rathbun Bull. 152 U.S. Nat. Mus., Washington 1930, 296. *Leptodius exaratus* = *Chlorodius exaratus* H. Milne Edwards, India.

Leptodius sanguineus (H. Milne Edwards).

Chlorodius sanguineus H. Milne Edwards Hist. Nat. Crust. 1, 1834, 402. Mauritius *Leptodius sanguineus* (H. Milne Edwards) Ward Aust. Zool. VII, III, 244 Heron Ild. Capricorn Group, Queensland.

The series before me gives a fine idea of the variation both of the colouration and the characters. There are sixteen specimens and no two are alike in colour. The mature female is more convex than the male and displays the usual disparity in the size of the chelipeds which are sub-equal, the male having one cheliped much more developed than the other.

The immature males and females resemble each other in the convexity of the carapace.

Material.—Seven females measuring from 14.5 mm. to 28.5 mm. across the carapace.

The only ovigerous specimen measures 20.2 mm.

Seven males measuring from 11 mm. to 25 mm. across the carapace.

Leptodius nudipes (Dana).

Chlorodius nudipes Dana Proc. Acad. Nat. Sci. Philad., 1852, 79; U.S. Explor. Exped., Crust. 1. 1852, 209; Atlas 1855, pl. xi, figs., 12a-c. Mangsi Islands.

Leptodius nudipes (Dana) Ward, Aust. Zool. VII, III, 1932, 244. Capricorn Group, Queensland.

There is a fine series in the collection which agree with the specimens I have collected from the reefs of the Barrier Reef, Queensland, the characteristic development of the anterolateral teeth is consistent throughout the series.

Material.—Six females measuring from 7.5 mm. to 10 mm. across the carapace; only one female, 10 mm., is ovigerous. Four males measuring from 7 mm. to 12 mm., across the carapace.

Leptodius cavipes (Dana).

Chlorodius cavipes Dana. U.S. Explor. Exped. Crust, 1, 1852, 212. "Locality uncertain".

Xantho (*Leptodius*) *cavipes* (Dana) Alcock, Journ. Asiatic Soc. Bengal lxvii, II, 1, 1898, 122. Andamans, Mergui, Ceylon

Leptodius cavipes (Dana) Rathbun Trans. Linn. Soc. London, (2) Zool., xiv, 2, 1911, 216. Peros, Coin.

Material.—One male measuring 12.5 mm. in total carapace width.

Leptodius planus sp. nov. (Pl. III, Fig 6a).

Description.—Carapace wider than long, convex anteriorly, regions defined by shallow grooves which become faint on the central portions. Surface granular the granules becoming more pronounced on the anterolateral margins, coarse punctæ are scattered over the surface.

Anterolateral margins quadridentate, the teeth scarcely produced sufficiently to break the curve of the margins. The fronto-orbital margin is as wide as the carapace is long; the orbits have an upward inclination. Their upper margins have faint indications of two sutures near the lateral angles.

The front is one third the total width of the carapace and is produced sufficiently to form, with the anterolateral margins, a graceful curve; the median notch is shallow, the lateral angles are produced into rounded teeth.

The subhepatic and pterygostomial regions are granular, the granules becoming finer towards the bases of the chelipeds; the epimeral walls of the carapace are clothed with a dense coating of long hairs which are absent from the sub-hepatic and pterygostomial surfaces.

The maxillipeds are granular and punctate, the granules being more developed on the merus than the ischium.

The chelipeds are subequal in both sexes. The walking legs have a few long golden hairs on their margins. These become more numerous on the distal articles.

L. planus differs from *L. exaratus* (H. Milne Edwards) in the following characters, compared with the description and figure of H. Milne Edwards.

1. The fronto orbital length is greater in *L. planus*.
2. The lateral teeth are not triangular, the anterior margin of each tooth being half the length of the posterior margin, nor are they produced as in *L. exaratus*.
3. The front is less produced in *L. planus*.
4. The dorsal surface of the carapace is less deeply areolated.

Material.—Four males measuring from 6 to 12.5 mm. in total carapace width. Three females measuring from 12.5 to 14.5 mm. in total carapace width.

Genus *Etisodes* Dana

Etisodes Dana. U.S. Explor. Exped., Crust. 1. 1852, 187.

Logotype. *E. frontalis* Dana. Sulu Sea.

This genus was erected by Dana who considered it as a sub-genus of *Etisus* Leach. The only differentiating characters then mentioned being the short merus of the cheliped and the narrow carapace. Ortmann considers it as a separate genus, but gets the species mixed with ones which actually belong to *Etisus* H. Milne Edwards. The original description of *Etisus* in the Hist. Nat. Crust., is concise and applies to *E. dentatus* (Herbst) and *E. anaglyptus* H. Milne Edwards and perhaps *E. utilis* Lucas.

Etisodes approaches certain of the species of *Leptodius* in the outline and lack of convexity of the carapace and the formation of the anterolateral margins. The front is decidedly unlike *Etisus* in form, being broader and less produced; in *Etisus* H. M. Edwards the front is equal to one third the breadth of the carapace, and is nearer to being half the breadth in *Etisodes* (measurement including the inner supra-orbital angles).

Etisodes albus sp. nov. (Pl. III, Fig. 5, 5a).

Description.—The length of the carapace, which is convex anteriorly and flat in the posterior half, is equal to three quarters of the breadth. The regions are clearly defined by shallow sulci; the surface is punctate. The hepatic regions and the lateral surfaces close to the margins are so densely punctate as to appear rugose.

The antero-lateral margins are thin and five toothed and there is a small tooth below the level of the lateral margin between the external orbital angle and the next lateral tooth. In each tooth the anterior margin is short and the posterior long so that the tip does not break the curve of the outline. There are one or two minute teeth between and on the same plane as the large teeth. The postero-lateral margins are concave and strongly convergent, the posterior margin is equal to the breadth of the front.

The front is deflexed and not greatly produced, it is cut into two teeth by a shallow notch, which is continued on the dorsal surface of the carapace as a sulcus which divides and outlines the mesogastric area. The frontal lobes are oblique in outline, the median notch is more advanced than the lateral angle and the margin is finely granular.

The orbits are large, the upper margin is thick and smooth and has one obscure suture; at the inner angle the margin becomes broad and flattened vertically (this can only be seen in a strictly frontal view). The lower margin is thin, sharp and visible from a dorsal view and there is an obsolete emargination immediately below the lateral angle.

The orbital hiatus is narrow and open, the antennæ not being excluded from the orbit. The antennular fossæ are deep and the inter-antennular septum is not strongly developed.

The external maxillipeds are smooth and punctate, the ischium is twice as long as the merus and both have the inner margins clothed with golden hairs.

The chelipeds are short, about as long as the carapace; the merus is hidden by the carapace; the carpus is as long as the merus, its outer surface pitted and irregular. The inner margin is thin and armed with one minute tooth followed by a broad

sub-acute angle near the articulation with the manus. The upper surface of the carpus near the inner margin is flat and polished as though continued rubbing against the sub-hepatic area of the carapace had removed all irregularities of the surface.

The manus is compressed, the outer surface rounded and ornamented with vertical lines of granules, and there is a short depressed line extending parallel with the lower margin onto the base of the immovable finger. The upper surface is rough and the margin is developed into a low carina, there is a second much less apparent carina extending parallel with the margin and lying in line with the articulation of the carpus. The lower margin is thin and smooth but not carinate.

The immovable finger is broad and armed with three teeth of which the middle one is the largest and is placed about mid way along the prehensile margin; there is a corresponding tooth on the dactylus which fits on the proximal side of the one on the immovable finger when the chelæ are closed.

The dactylus of the cheliped is thick and strongly curved, its upper margin is carinated, the carina being delimited by shallow longitudinal furrows.

The ambulatory legs are compressed and their upper margins armed with curved spines which are hidden by hairs, these hairs are long and thin and become numerous on the distal articles.

The tomentum on the epimeral walls of the carapace does not reach the lateral margins.

The female holotype measures 13.5 mm. and the male holotype 10.5 mm., across the carapace.

The species is allied to *E. frontalis* Dana, Sulu sea, and *E. demani* Odhner. It differs from *E. frontalis* as defined by Dana in the less produced front and the formation of the anterolateral teeth. Also the anterolateral angle of the merus of the external maxilliped is produced into a rounded angle and is not square as in *E. frontalis* Dana.

E. albus differs from *E. demani* Odhner in the formation of the front, the anterolateral margin and many other characters.

Material.—Two females measuring 13.5 and 14 mm. in total carapace width. One male measuring 10.5 mm. in total carapace

Genus *Medæus* Dana.

Medæus Dana. U.S. Explor. Exped. Crust. 1. 1852, 181.

Haplotype. *M. ornatus* Dana.

Type Locality. Lahaina, Island of Maui, Hawaii. Dredged.

Medæus noelensis sp. nov. (Pl. I, Fig. 1, 1a).

The outline of the carapace resembles *Medæus granulosus* (Haswell) and *M. distinguendus* (de Haan). It is readily

separated from them by the smooth condition of the carapace, by the broader, less produced front and in lacking some of the lateral teeth.

Description.—Carapace broader than long, areas clearly defined. The surface smooth to the naked eye, covered with uniform granules which are only apparent under a strong lens, and which do not form transverse ridges. The anterolateral teeth are not as developed as in *M. granulosus* Haswell.

The carpus and manus of the cheliped are not as deeply sculptured as in either of the related species. The articles of the walking legs have shallow longitudinal grooves, not deep as in *M. granulosus* (Haswell).

Material.—One male measuring 6.5 mm. in total carapace width.

Sub-family ACTÆINÆ

Genus *Actaea* de Haan.

Actaea de Haan, Fauna Japonica Crust., 1833, 4 and 18.

Logotype specified by Rathbun Bull., 152 U.S. Nat. Mus. Washington 1930. 250. *A. savignii* (H. Milne Edwards).

Type locality. Red Sea.

Actaea suffuscula Rathbun.

Actaea suffuscula Rathbun Trans. Linn. Soc. London, (2) Zool., xiv, 2, 1911, 220, Pl. xvii, F. 10. Coetiv, Samoa.

Odhner unites this species with *A. consobrina* A. Milne Edwards but I prefer to wait until I have material from the type locality of *A. consobrina* before taking such action. There are specimens in my collection from the Capricorn group, Queensland which I have recorded as *A. consobrina* A. Milne Edwards, and these do not agree in detail with the series present in this collection.

Material.—Two males measuring 7 and 8 mm., across the carapace. One female measuring 7 mm. across the carapace.

Actaea fossulata (Girard).

Cancer fossulata Girard, Ann. Soc. Entom. France (3) vii, 1859, 149, pl. iv, fig. 2a-b. Red Sea.

Actaea fossulata (Girard) Alcock Journ. Asiatic. Soc. Bengal, lxvii, II, 1, 1898, 148, Andamans.

There are specimens of *A. cavipes* (Dana) before me from the Great Barrier Reef of Queensland; the specimen of *A. fossulata* differs from them in several important characters most conspicuous of which is the development of the anterolateral teeth. In *A. fossulata* they are strongly developed and triangular, those of *A. cavipes* being scarcely noticeable.

Material.—One male measuring 10 mm., across the carapace.

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Actaea rufopunctata (H. Milne Edwards).

Xantho rufopunctatus H. Milne Edwards, Hist. Nat. Crust. 1, 1834, 389. Mauritius.

Actaea rufopunctata (Milne Edwards) Alcock Journ. Asiat. Soc. Bengal, lxvii, II, 1, 1898, 142 synonymy except *A. nodosa* Stimpson.

Material.—One male measuring 8.5 mm., across the carapace.

Actaea tomentosa (H. Milne Edwards).

Zoymus tomentosus H. Milne Edwards Hist. Nat. Crust. I. 1834, 385 and in Cuvier Regne Animal, Crust. pl. xi, bis, fig. 2. Indian Ocean.

Actaea tomentosa Alcock Journ. Asiat. Soc. Bengal, lxvii, II, 1, 1898, 140.

Material.—Six females ranging from 11.5 mm., to 21.5 mm., across the carapace, in this species the females do not appear to breed until large size is attained, none of the present series is ovigerous and the smaller specimens have narrow masculine abdomens. Ten males ranging from 8 mm., to 22 mm., across the carapace.

Genus *Daira* de Haan

Daira de Haan, Fauna Japonica, Crust., 1833, 18. Alcock Journ. Asiat. Soc. Bengal, lxvii, II, 1, 1898, 154.

Logotype specified by Rathbun Bull. 152, U.S.N. Mus. Wash. 1930, 268. *D. perlatus* (Herbst) Type locality unknown.

Daira perlata (Herbst).

Daira perlata (Herbst) Alcock, Journ. Asiat. Soc. Bengal, lxvii, II, 1, 1898, 155.

In the smaller males the sexual organs are scarcely visible and the only means of differentiating between the sexes is the presence or absence of the female apertures in the sternum. In the fully grown females which are in my collection from other localities the abdomen is broad and rounded, but in the present series there is no difference between the sexes in the narrow outline.

The colouration is interesting; of the three females, two are dark brown. One has the carapace almost white with its legs variegated with brown and white. Of the five males, the smallest is white on the carapace, the two largest are almost white, and the two intermediate sized are dark brown.

Material.—Three females measuring from 10 mm., to 14 mm., across the carapace. Five males measuring from 6.5 mm., to 10 mm., across the carapace.

Sub-family CHLORODINÆ

Genus *Xanthias* Rathbun

Xanthias Rathbun, Bull. 152, U.S. Nat. Mus. Wash., 1930, 464.

Logotype *X. lamarchii* (H. Milne Edwards) 1834, Mauritius.

Xanthias lamarckii (II. Milne Edwards).

Xantho lamarckii II. Milne Edwards, Hist. Nat. Crust. 1, 1831, 391
Mauritius.

Xanthodes lamarckii (H. M. Edw.), Alcock Journ. Asiatic Soc. Bengal, Ixvii, II, 1. 1898, 157. Andamans, Madras coast and Ceylon.

Xanthias lamarckii (H. M. Edw.), Odhner, K. Vet. O. Vitterh. Samh. Handl. Band, 29. 1, 1924, 84.

Material.—Four females measuring from 11.5 to 17.5 mm. across the carapace. Two males measuring 11.5 and 12.5 mm., across the carapace.

Genus Paraxanthias Odhner.

Paraxanthias Odhner K. Vet. O. Vitterh. Samh. Handl. Bd 29. 1. 1924, 85.

Orthotype. *P. notatus* (Dana).

Type locality. Paumotu (Dana).

Paraxanthias hæmatostictus sp. nov. (Pl. II, Fig. 3, 3a).

Description.—Carapace nearly two thirds as long as it is wide, the surface microscopically granular, the inter-regional sulci not strongly developed; the regions not inflated. Antero-lateral margins armed with four tuberculiform teeth, the last two surrounded by short hairs, these are not dense enough to hide the lateral teeth. The fronto-orbital margin is half as wide as the carapace. The front is curved and has a wide median notch, the lateral angles are developed into rounded teeth, the orbit is half as wide as the front, the supra-orbital margin has two obsolete sutures near the lateral angle and one well developed just below the lateral angle. The orbital hiatus is broad and the antenna stands in the space.

The epimeral walls of the carapace are clothed with a coat of long hair which extends onto the dorsal surface of the carapace at the lateral angles, the sub-orbital areas are free of hair and there are few hairs on the external maxillipeds, but the margins of the abdomen are fringed with long hair which fills the lines of articulation; there is also a broad V-shaped patch of hair on the anterior surface of the sternum.

The chelæ are unequal; the manus is smooth, the outer surface punctate, an impressed row of punctæ near the upper margin. The dactylus is thick and acuminate and armed with six broad teeth, the immovable finger is armed with three teeth two of which are situated near the middle, the third is near the acclivous tip. The carpus resembles the manus in its smoothness and there are two well developed teeth at the inner angle. The merus is short. Its upper margin sharp and covered with granules and fringed with long hairs.

The ambulatory legs are slender and fringed with long hairs which spread over the whole surface of the last two articles resulting in a shaggy appearance.

P. haematostictus differs from the other recognised species of the genus in the great development of the hairs on the legs and the lateral angles of the carapace. The nearest related species appears to be *Xanthodces nitidulus* Dana, but is readily differentiated by the small anterolateral teeth on the carapace, the patches of hair on the anterolateral angles of the carapace, the weak articulation of the carapace and the rounded upper margin of the manus.

Material.—One female measuring 17.5 mm., across the carapace. There is a Bopyrid parasite in the gill cavity of the right side.

Genus *Chlorodopsis* A. M. Edwards

Chlorodopsis A. Milne Edwards *Nouv. Arch. Mus. Hist. Nat. Paris*, ix, 1873, 227. *Idem. Alcock, Journ. Asiat. Soc. Bengal. Lxvii*, II, 1, 1898, 165.

Type *Chlorodopsis melanochirus* A. Milne Edwards.

Type locality. New Caledonia.

Chlorodopsis natalensis sp. nov. (Pl. I, Fig. 6, 6a).

Carapace longitudinally convex, the sulci which delineate the regions of the dorsal surface are shallow and smooth, the major areas are not subdivided. The entire surface is covered with uniform granules. The anterolateral margins are armed with four broad, blunt teeth; the first of which is fused with the outer orbital angle, the second and third are more salient, but not acuminate. The fourth is as developed as the first. The orbits are large, the margins are broken by two obsolete fissures above, and are entire below, the edges are granulate. The front is deflexed and has a broad shallow median notch, the two resultant lobes have a thickened granular edge, their lateral angles are not marked.

In the external maxillipeds the ischial article is twice the length of the meral article and there is a faint longitudinal groove near the opposed edges. The meral articles are auriculate at the antero-external angles.

The chelipeds are unequal. The merus of the major chela is scarcely visible beyond the carapace. The carpus is rounded and uniformly granular and armed at its inner angle with a broad blunt spine. The manus resembles the carpus with its coating of granules which become smaller on the outer and lower surfaces, disappearing completely on the proximal half of the immovable finger. The dactylus is as long as the upper margin of the manus. It is carinated dorsally owing to the two longitudinal grooves. There is a second less noticeable groove on the outer surface. There are two low triangulate teeth on the proximal half and the tip is spoon-excavated. The immovable finger is

grooved on the outer surface near the lower margin and has a single large tooth placed half way from the base. The ambulatory legs are slender and fringed with long hairs along the upper margins of the articles.

C. natalensis approaches *C. venusta* Rathbun, but is readily separated by the following characters—

1. The anterolateral teeth are broad and not spinate.
2. There are no narrow acute teeth outside the lobe of the front.
3. The arm of the cheliped is not spined on its anterior border.

Material.—One male designated as type 7.5 mm. across the carapace. Three males measuring 6.5 to 7 mm., across the carapace. Two females measuring 7 and 7.5 mm., across the carapace.

Genus *Phymodius* A. Milne Edwards

Phymodius A. Milne Edwards, Ann. Sci. Nat. (4), xx, 1863, 283.

Logotype specified by Rathbun Bull. 152 U.S. Nat Mus., Washington, 1930, 294. *P. unguilatus* (H. M. Edw.).

Type Locality. Australasia. (H. M. Edw.).

Phymodius sculptus (A. Milne Edwards).

Chlorodius sculptus A. Milne Edwards Nouv. Arch. Mus. Hist. Nat. Paris. ix, 1873, 217, pl. viii, fig. 4. New Caledonia.

Phymodius sculptus. (A. Milne Edwards) Alcock Journ. Asiatic Soc. Bengal, lxvii, II. 11. 1898. 164. Andamans; Mergui. Ceylon.

Material.—Two males measuring 15.5 and 22 mm. across the carapace. Two females measuring 15 and 18 mm. across the carapace.

Genus *Tweedieia* nov.

The most striking characteristic of this genus is the development of the fronto-orbital margin. The front is bilobed and between each lobe and the orbit is a deep rounded fissure formed by a folding back of the margin in such a way that the outer angles of the antennular fossæ very nearly open on the dorsum of the carapace. The lateral angles of the front are fused with the inner supra-orbital angles. The orbital margins are not grooved and the orbits have a dorsal inclination. The orbital hiatus is narrow and a slender prolongation of the basal article of the antennæ extends into it, the flagella stand in the hiatus, the basal segment pressed against the angle of the orbit.

The chelæ are equal in size and short.

Tweedieia noelensis sp. nov. (Pl. I, Fig. 2, 2a).

Carapace flat except in the anterior third where it is moderately inclined. The surface is areolated, the protogastric

CRABS FROM CHRISTMAS ISLAND

lobes not subdivided; the hepatic area is separated from the branchial by a deep sulcus; the branchial region is also subdivided. Anterolateral margin curved and armed with four teeth.

The chelæ are equal, the merus scarcely visible beyond the lateral margins of the carapace; the carpus is granular and has three nodular swellings on the outer surface. The inner angle bears two conical spines. The manus is broad, the lower margin twice the length of the upper margin. The outer surface is ornamented with rows of conical spinose granules intermixed with fine golden hairs. The dactylus is short, strongly curved and ornamented on the proximal half with granules similar to those on the manus; the tip is spoon-excavate and there is a large tooth near the base. There are several bunches of long stiff, golden hairs on the outer surface which mask the gape between the big tooth and the tip. The ambulatory legs are densely fringed with long golden hairs.

Material.—One male measuring 10 mm. across the carapace.

Sub-family MENIPPINÆ

Genus *Pseudozius* Dana

Pseudozius Dana, Sillimans Jour. (2) xii. 1851, 127; Proc. Acad. Nat. Sci. Philad. 1852, 81; and U.S. Explor. Exped. Crust. I. 1852, 232.

Logotype specified by Ward, Austr. Zool. vii, iii, 1932, 252. *Pseudozius planus* Dana.

Type locality. Waterland Island, Raraka Island or Paumotu.

Pseudozius caystrus (Adams and White).

Panopeus caystrus Adams & White Voy. Samarang, Zool. Crust. II. 1849, 42 pl. ix, f. 2. Eastern Seas.

The species is closely related to the type species but I have not followed Alcock in placing *P. planus* Dana as a synonym of *P. caysirus* (Adams and White) owing to the lack of accessible material from the type locality of *P. planus* Dana. The specimens in this collection fit the figure and description of the Samarang species and not those given by Dana of *P. planus*.

Material.—Four females measuring 12 mm. across the carapace and two adults measuring 17.5 mm., and 20 mm., across the carapace. One male measuring 11 mm., across the carapace.

Family GRAPSIDÆ

Sub-family PLAGUSIINÆ

Genus *Percnon* Gistel

Percnon Gistel Naturg. Thierreichs, 1848, 8; Rathbun Bull. 97, U.S. Nat. Mus. Washington, 1918, 387.

Logotype. *P. planissimum* (Herbst).

Type locality. East Indies.

MELBOURNE WARD

Percnon demani nom. nov. Pl. III, Fig. 3, 3a.

Leiophus abbreviatus de Man (nec. Dana)

Abhandl. d. Senkenb. Ges. 1902, 544, Pl. xx, f. 13. Ternate.

I have specimens of the true *Percnon abbreviatus* Dana from the Hawaiian Islands, these differ from *P. demani* in the formation of the carapace, which is square, not narrowed anteriorly (See figures).

Material.—Eleven males measuring from 4.5 mm. across the carapace to 15 mm. One female, immature, measuring 9 mm. across the carapace.

Sub-family GRAPSINÆ

Genus *Grapsus* Lamarck

Grapsus, Lamarck, Sys. Anim. sans Vert., 1801, 150.

Logotype specified by Rathbun Bull. 97, U.S. Nat. Mus. Washington 1918, 226. *G. pictus* Latreille—*G. grapsus* (Linn.).

Grapsus intermedius de Man.

Grapsus intermedius de Man Archiv., fur Naturges. 53, 1, 1887, 365, pl. 16, fig. 1.

Idem. Tesh, Siboga-Exped., xxxix c, 1918, 71.

Tesch gives a key to species of *Grapsus* briefly noting the structural differences which separate *G. intermedius* de Man from the allied *G. strigosus* (Herbst) and *G. maculatus* (Catesby).

I have examined many specimens of *G. strigosus* (Herbst) and the group of species usually listed in the synonymy of *G. grapsus* (Linn.) and find that *G. intermedius* differs in many characters of formation.

G. tenuicrustatus (Herbst) occurs on the coast of India and has been recorded by Alcock in his Carcinological Fauna of India as *G. grapsus* (Linn.) which is confined to the New World. I possess specimens of both species, one from the Indian Museum—*tenuicrustatus* (Herbst). and several from Cuba and Panama, *G. grapsus* (Linn.).

G. tenuicrustatus (Herbst) is very like *G. grapsus* (Linn.), but is readily separated by the more developed raised lines on the gastric regions, the more irregular surface of the carapace generally, by the broader propodites of the ambulatory legs which in *G. tenuicrustatus* (Herbst) are one third as broad as long whereas in *G. grapsus* (Linn.) they are one quarter as broad as they are long. The front is steeply inclined in both species, but the distance between the epigastric lobes and the margin of the front is greater in *tenuicrustatus* (Herbst) than in *grapsus* (Linn.).

The difference between *G. intermedius* de Man and *G. tenuicrustatus* (Herbst) is more apparent. The carapace is not narrowed anteriorly in *G. intermedius*, the front is broader. The

distance between the epigastric lobes and the margin not as great as in *G. tenuicrustatus*, also the transverse ridges are more developed.

From *G. strigosus* (Herbst) the species differs in the broader front and the parallel lateral margins of the carapace.

Material.—Three males 17 mm. 18.5 and 22 mm. across the carapace. Three females 18.5 mm., 21 mm. and 22 mm. across the carapace.

Genus *Pachygrapsus* Randall

Pachygrapsus Randall, Journ. Acad. Nat. Sci. Philad. viii. 1839. (1840) 127. Idem. Rathbun Bull. 97, U.S. Nat. Mus. Washington 1918, 240.

Logotype specified by Rathbun, loc. cit. 1918, 240. *P. crassipes* Randall. Hawaiian Islands?

Pachygrapsus natalensis sp. nov. (Pl. III, Fig. 4, 4a).

Related to *Pachygrapsus plicatus* (H. M. Edwards) but differs from that species (specimens compared) in the proportions of the carapace which is broader in the Hawaiian species. The chelæ are more inflated in *P. natalensis* in the male.

The length of the carapace is equal to three quarters of the width. The depth of the cephalothorax through the middle is equal to half the width of the carapace. The dorsal surface of the carapace is crossed by ridges ornamented with hairs similar to those on *P. plicatus* (H. M. Edwards).

The front is about half as wide as the carapace; the margin sinuous and deflexed. The epigastric lobes are developed but not as strongly as in *P. plicatus* (H. M. Edwards). Orbita as in *P. plicatus* (H. M. Edwards). The meri of the ambulatory legs are broader than those of the related species.

Material.—Two males measuring 12.5 mm. and 14 mm., across the carapace. The larger of the two is the type. Two females 12 and 13.5 mm., across the carapace.

Pachygrapsus murrayi (Calman).

Sesarma murrayi Calman Proc. Zool. Soc. London 1909, 708, pl. lxii, figs. 4 and 5.

This species is closely allied to *P. minutus* A. Milne Edwards, New Caledonia.

Material.—Six males measuring from 5.5 mm., to 8.5 mm., across the carapace. Seven females measuring from 6 to 8 mm., across the carapace; there are three ovigerous individuals.

Pachygrapsus planifrons de Man.

Pachygrapsus planifrons de Man. Archiv. f. Naturgesch. 53 Jahrg. 1888, 368, pl. xvi, f. 2. Insel. Noordwachter.

The species is readily recognised by the flattened condition of the carapace, the concave outline of the lateral margins, the

tuft of hairs on the tips of the dactyli and immovable fingers of the chelipeds, the sinuous outline of the front and the small size of the entire crab.

Material.—Five males ranging from 5 mm. to 12 mm. across the carapace. Five females ranging from 4 mm. to 11 mm. across the carapace.

Genus *Pseudograpsus* II. Milne Edwards

Pseudograpsus H. Milne Edwards, Hist. Nat. Crust., II, 1837, 81.

Logotype. *Pseudograpsus penicilliger* (Latreille).

—*Grapsus penicilliger* Latreille 1817.

—*Cancer setosus* Fabricius preoccupied by *Cancer setosus* Molina 1782 Chili.

Type locality. East Indies.

Pseudograpsus crassus A. Milne Edwards.

Pseudograpsus crassus A. Milne Edwards Nouv. Arch. Mus. Hist. Nat. Paris, iv. 1868, 176, Pl. xxvi, Fig. 6-10., Celebes.

The quoted figure is apparently of an adult male.

Material.—One female measuring 8 mm., across the carapace.

Family GECARCINIDÆ

Genus *Hylaeocarcinus* Wood Mason

Hylaeocarcinus Wood Mason. Journ. Asiat. Soc. Bengal. XLII, II, 1873, 259.

Haplotype. *Hylaeocarcinus humei*. Type Locality. Nicobar Islands. Wood Mason.

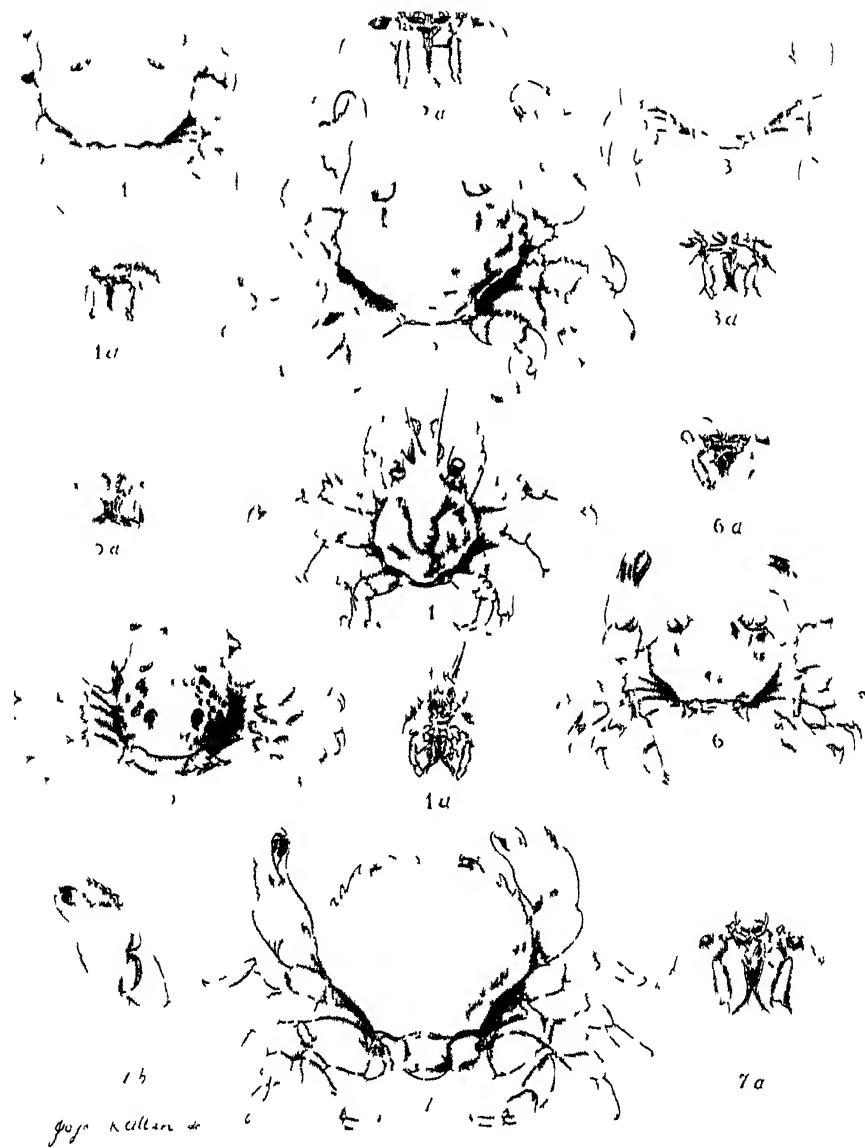
Hylaeocarcinus natalis Pocock. (Pl. II, Fig. 4 4a).

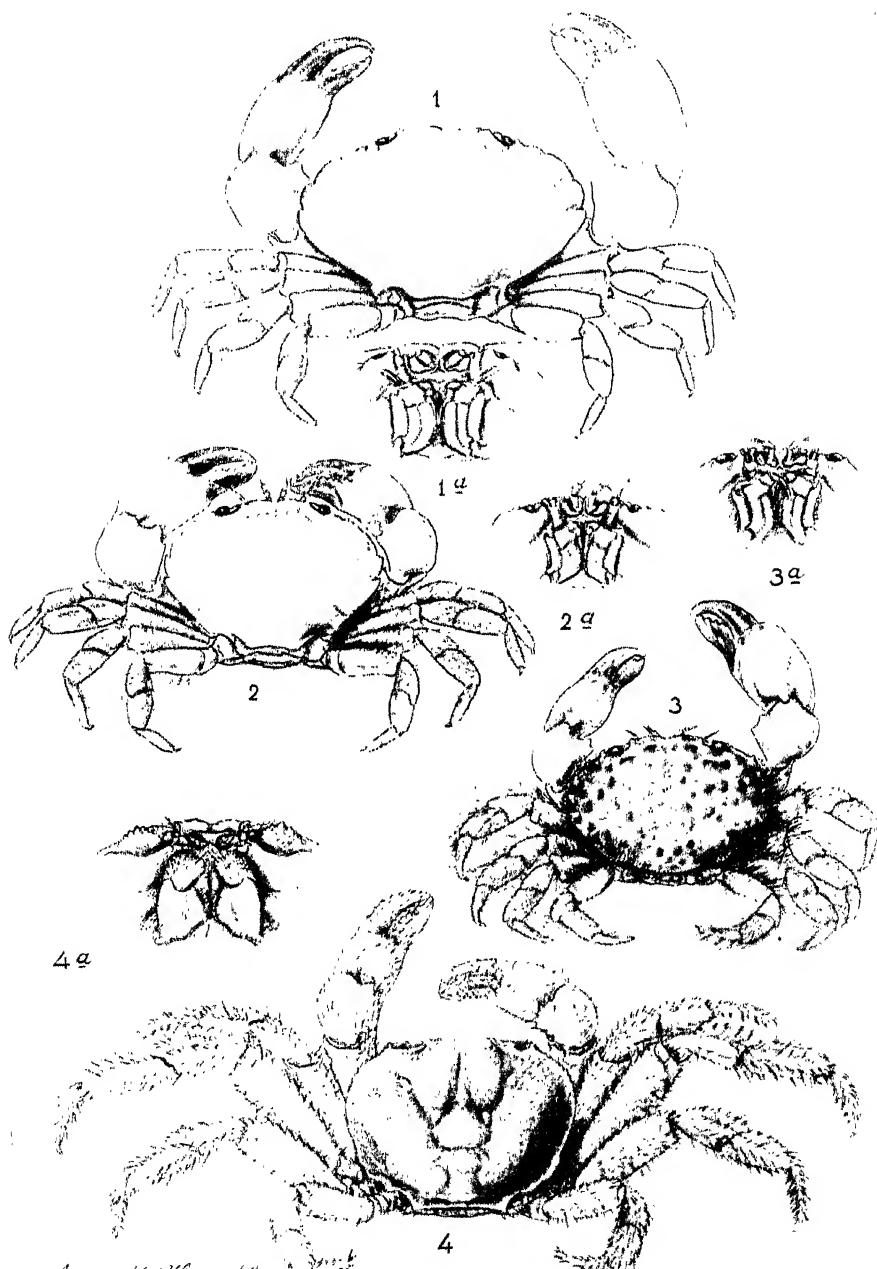
Hylaeocarcinus natalis Pocock. Proc. Zool. Soc. London, 1888, 561. Christmas Island.

Gecarcoidea lalandii Calman, (nec. H. M. Edwards), Proc. Zool. Soc. London. 1909, 710.

Hylaeocarcinus natalis Pocock differs from allied species in that it has only four rows of spines on the dactyli of the walking legs instead of six. The smooth "scars" on the carapace are larger and more obvious than those on the allied species. The one near the lateral angle the orbit is very large. This character is of interest from the fact that it becomes more marked in the larger individuals, being scarcely visible on the juveniles. The ambulatory legs are longer and more slender than in the allied species, specimens of which are before me from New Britain. The fine series of *H. natalis* Pocock in the collection under discussion enables me safely to affirm the validity of the species.

Material.—Five females ranging from 13.5 to 24 mm., across the carapace. A series of twenty-five juveniles.





Joyce K. Wan



CRABS FROM CHRISTMAS ISLAND

EXPLANATION OF PLATE I

Medacus noelensis sp. nov.

Fig. 1. Dorsal view of the holotype measuring 6.5 mm., in total carapace width.

Fig. 1a. Ventral view of the anterior portion.

Tweddieia noelensis gen. and sp. nov.

Fig. 2. Dorsal view of the holotype measuring 10 mm., in total carapace width.

Fig. 2a. Ventral view of the anterior portion.

Atergatis tweddiei sp. nov.

Fig. 3. Dorsal view of the holotype measuring 9 mm., in total carapace width.

Fig. 3a. Ventral view of the anterior portion.

Hyastenus macrospinosis sp. nov.

Fig. 4. Dorsal view of the holotype measuring 10 mm., in total carapace width, including the rostral spines.

Fig. 4a. Ventral view of the anterior portion.

Proechinoecus sculptus gen. and sp. nov.

Fig. 5. Dorsal view of the female holotype measuring 6.5 mm., in total carapace width.

Fig. 5a. Ventral view of the anterior portion.

Chlorodopsis natalensis sp. nov.

Fig. 6. Dorsal view of the holotype measuring 7.5 mm. in total carapace width.

Fig. 6a. Ventral view of the anterior portion.

Kraussia proporellana sp. nov.

Fig. 7. Dorsal view of the holotype measuring 12 mm. in total carapace width.

Fig. 7a. Ventral view of the anterior portion.

EXPLANATION OF PLATE II

Lioxantho subacuta (Stimpson)

Fig. 1. Dorsal view of male measuring 15 mm., in total carapace width.

Fig. 1a. Ventral view of the anterior portion.

Lioxantho lacvivorsalis (Miers)

Fig. 2. Dorsal view of female measuring 11.5 mm. in total carapace width.

Fig. 2a. Ventral view of the anterior portion.

Paraxanthius haematositicus sp. nov.

Fig. 3. Dorsal view of holotype measuring 17.5 mm., in total carapace width.

Fig. 3a. Ventral view of the anterior portion.

Hylaeocarcinus natalis Pocock

Fig. 4. Dorsal view of female measuring 21 mm., in total carapace width.

Fig. 4a. Ventral view of the anterior portion.

EXPLANATION OF PLATE III

Percnon abbreviatus (Dana)

Fig. 1. Dorsal view of female measuring 13 mm., in total carapace width. The specimen was collected on the reefs in the Hawaiian Islands and is housed in the Ward Collection Sydnycy.

Fig. 1a. Ventral view of the anterior portion.

Pseudolionomera natalensis sp. nov.

Fig. 2. Dorsal view of male measuring 13 mm., in total carapace width.

Fig. 2a. Ventral view of the anterior portion.

Percnon demani nom. nov.

Fig. 3. Dorsal view of male measuring 15 mm., in total carapace width.

Fig. 3a. Ventral view of the anterior portion.

Pachygrapsus natalensis sp. nov.

Fig. 4. Dorsal view of the male type measuring 14 mm., in total carapace width.

Fig. 4a. Ventral view of the anterior portion.

Etisodes albus sp. nov.

Fig. 5. Dorsal view of the female holotype measuring 13.5 mm., in total carapace width.

Fig. 5a. Ventral view of the anterior portion.

Leptodius plumis sp. nov.

Fig. 6. Dorsal view of type measuring 10.5 mm., in total carapace width.

Fig. 6a. Ventral view of the anterior portion.

New Freshwater Decapod Crustaceans from the
Malay Peninsula

By DR. JEAN ROUX (Basle Museum of Natural History)

PLATE IV

Recently the Basle Museum of Natural History received a small collection of fresh water Crustaceans from the Malay Peninsula for identification. Among this material, 2 species and 1 subspecies are apparently undescribed; they are here recorded under the following names:

Potamon (Potamiscus) chaseni n. sp.

Potamon (Potamiscus) tweediei n. sp.

Palæmon (Macrobrachium) pilimanus malayanus n. subsp.

We wish to express our best thanks to Mr. F. N. Chasen, Director of the Raffles Museum, Singapore, who has given us the opportunity of studying this interesting material, and has allowed us to retain some of the specimens for the collections of the Basle Museum.

Potamon (Potamiscus) chaseni n. sp.

(Text Fig. 1; Pl. IV, Fig. 1, 2)

Locality.—Camerons Highlands, Malay Peninsula.

This new species appears to be related to *Potamon tumidulum* Alcock but belongs to the subgenus *Potamiscus* in having only a small vestige of a flagellum to the exopodite of the external maxillipeds.

Carapace convex fore and aft; length four fifths breadth, depth more than half the middle length. The cervical groove is well marked in all its course and breaks the post-orbital crest at a point immediately behind the external orbital angle. The mesogastric and epigastric regions are distinct. The epibranchial regions are subdivided by two grooves as in *Pot. alcockianum* Kemp; one groove runs obliquely backwards from the outer limit of the mesogastric area, the other more or less parallel with the cervical groove. The anterior part of the carapace is not coarsely rugose. The epibranchial regions only are decorated with rounded, not very salient rugæ. The central parts of the gastric region are punctate. The fine striæ of the postero-lateral border are very slightly developed. The posterior breadth of the carapace is half the distance between the extraorbital angles.

The epigastric crest forms a common curve with the postorbital; the epigastric lobes are tumid and separated from each other by a deep and very narrow furrow; they are not in advance of the posterior border of the orbits. The postorbital crests are well defined in their whole course and transversely rugulose; at the points where they are cut by the cervical groove, they tend forwards in a straight line towards the bases of the epibranchial teeth and are also here very well defined and rugulose.

The front is moderately declivous; its anterior border is not crenulate and is broadly bilobed in dorsal view; its breadth is equal to 1/3 of the length of the carapace. The frontal surface is finely granulose throughout, the postorbital regions are concave and also minutely granulated.

The external orbital angle is not developed into a tooth, it is separated by a very small gap from the lower border of the orbit; the orbital borders are granulose. The antero-lateral borders are about as long as the postero-lateral; they are strongly curved and granulate and extend backwards to the level of the

posterior limit of the mesogastric area. The epibranchial tooth is not more developed than the surrounding granulæ of the borders.

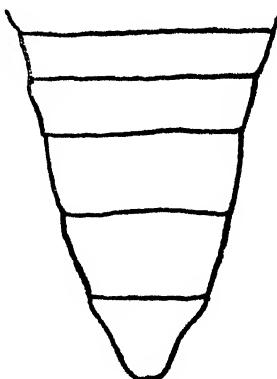


Fig. 1. *Potamon (Potamiscus) chaseni*, n. sp.
♂ abdomen, $\times 3$.

In the male the length of the sixth abdominal segment is a little less than half the basal breadth. The seventh segment is about as long as the preceding one, it is $1/3$ broader than long.

The merus of the third maxilliped is as broad as long; the longitudinal groove on the ischium is well defined and placed a little nearer to the inner than to the outer border. The exopodite bears only a vestigial flagellum.

The right cheliped only is present. The edges of the merus are crenulate, without a tooth near the distal end of the upper border; its surface is nearly smooth. The carpus bears a coarse spine with a large base; on the inner side of this joint are two small denticles. Palm smooth on the outer surface except for some coarse punctations, not much swollen. Fingers not gaping, as long as the palm, pitted and furnished with longitudinal lines; inner border with about 20 small teeth.

Walking legs moderate, furnished with short bristles. In the foremost posterior pair, which are 4 cent. long, the merus is $2\frac{3}{4}$ as long as broad, without any spine near the proximal end on the upper border; the dactylus is a little longer than the propodus.

In the well defined cervical groove, this species agrees with *P. tumidulum* Alck. but differs as follows: the carapace is more vaulted, the postorbital crests are well defined on their whole course, the epibranchial tooth is not distinct, the last abdominal segment in the male is distinctly broader than long.

Potamon (Potamiscus) tweediei n. sp.

(Text Fig. 2; Pl. IV, Fig. 3, 4).

Locality.—Maxwells Hill, Perak. 3000', 2 ♂♂.

This species is very nearly related to the preceding form with which it agrees in the proportions of the carapace and of the limbs.

The differences noticed are as follows:

The outwardly curved lateral portion of the cervical groove is a shallow depression which does not cut the post-orbital crest. The epigastric crests are slightly in advance of the post-orbital, reaching the level of the upper orbital margin. They are rugulose, tending obliquely backwards; they are separated from the post-orbital crest by a distinct furrow. The post-orbital crests are not rugulose and do not run obliquely backwards, but form a sharp-edged, transverse line on each side of the epigastric crests. They are continued up to a point where the cervical groove would cut them, if it were defined anteriorly, and are afterwards gently curved forwards in the vicinity of the epibranchial tooth, forming here 2 or 3 more or less well defined rugosities.

The anterior lobes of the front are less curved and the frontal surface less tuberculate; the post-orbital area is quite smooth.

The granulations of the antero-lateral border are finer. The side-walls of the carapace are quite smooth and the boundaries between these regions devoid of granules.

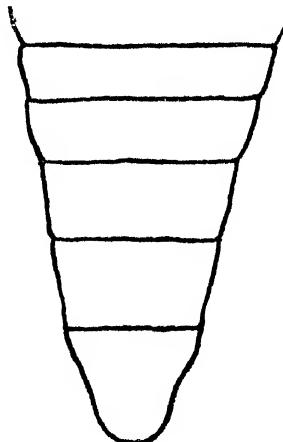


Fig. 2. *Potamon (Potamiscus) tweediei*, n. sp.
♂ abdomen, $\times 3$.

The height of the 6th abdominal segment of the ♂ is a little more than half of the proximal breadth; the last segment is longer than the 6th, its length about 1/5 of its breadth.

The outer surfaces of the carpus and palm of the chelipeds are more rugulose.

This species is named after Mr. M. W. F. Tweedie, Officiating Curator at the Raffles Museum.

Palæmon (Macrobrachium) pilimanus malayanus n. subsp.

Locality.—Lasah, Plus Valley, East Perak, March, 1933.; numerous specimens. This new subspecies is undoubtedly derived from the typical form of *Pal. pilimanus* de Man, which was found at the same locality.

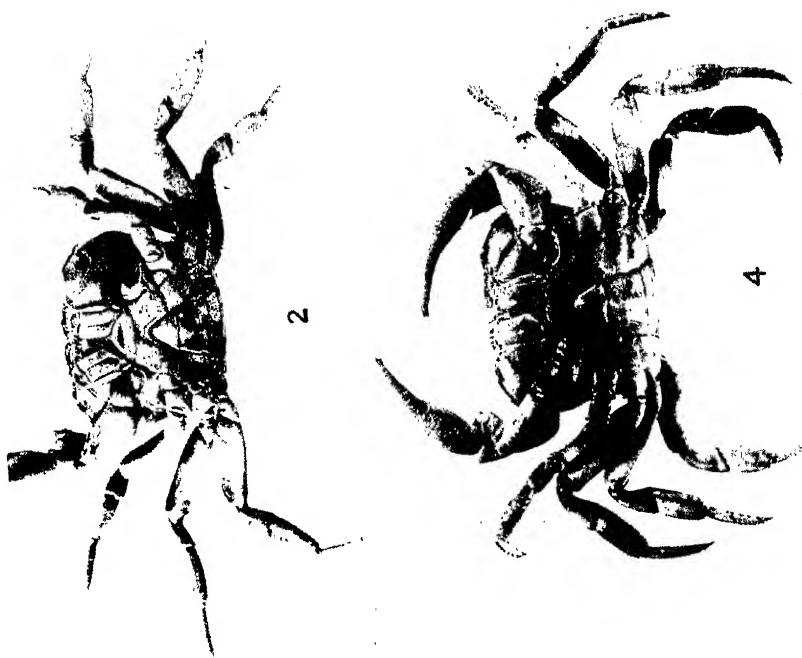
De Man¹ has already pointed out that *Pal. pilimanus* is a very variable species. He described the var. *leptodactylus* for Javanese specimens which were collected with the typical form at Buitenzorg. These specimens have a more elongated carpus in the II. chelipeds than in the true *pilimanus*.

Amongst the numerous specimens from Lasah, we also were able to distinguish, besides normal individuals, others with the carpus elongated, showing also different characters in the rostrum and in the I. chelipeds. They have the same dimensions as the typical *Pal. pilimanus* (tot. length 38–40 mm.). The rostrum is horizontal, being a little longer than the antenular peduncles but shorter than the antennal scale; it is not convex in the supra-orbital region and seems not so high as in the typical form. The teeth are less numerous, there being 8–10 on the upper border, the 3 proximal ones on the cephalothorax; on the lower margin 3–4 teeth. The telson has the typical form.

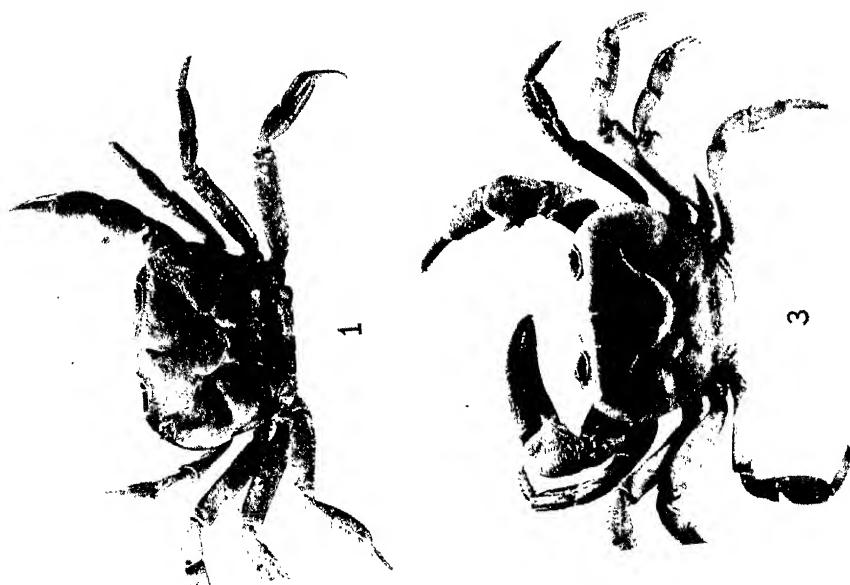
The I. chelipeds are shorter than in the true *Pal. pilimanus*, but their carpus is projected beyond the antennal scale.

The II. chelipeds are very different in shape and unequal in length, especially in the ♂. The carpus is elongated, remaining, however, a little shorter than the merus. The chela has the same form as in the typical specimens from Lasah, the palm being a little longer than the fingers. The merus and carpus are provided with short spinules; on the palm these spinules are very few in number. This segment bears a soft fur which reaches its maximum length on the fingers. In the larger cheliped the palm is twice as broad as the distal part of the carpus. The

¹. In M. Weber: Zoolog Ergebnisse einer Reise in Niederl. Ost-Indien, Bd. II, S. 472, 473.



... - Malacca Peninsula.



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inner margin of the fingers is provided with 2 rounded teeth only, the basal one being preceded by 2 small tubercles. In the smaller cheliped, the palm is nearly as broad as the carpus, so that the general shape is as in a *Parupalaemon*; the fingers are armed with 2 small teeth. The whole segment bears long, flexible setæ.

In the ♀ specimens, the difference in the shape of the chelipeds is less marked than in the ♂, and palm of the great cheliped is not so broad.

The ova are spherical, large and few in number.

EXPLANATION OF PLATE IV

Fig. 1. *Potamon (Potamiscus) chaseni*, n. sp. Dorsal view, $\times 1$.
Fig. 2. *Potamon (Potamiscus) chaseni*, n. sp. Ventral view, $\times 1$.
Fig. 3. *Potamon (Potamiscus) tweediei*, n. sp. Dorsal view, $\times 1$.
Fig. 4. *Potamon (Potamiscus) tweediei*, n. sp. Ventral view, $\times 1$.

Notes on Stomatopoda in the Raffles Museum,

By M. W. F. TWEEDIE, M.A.

The Stomatopoda are represented in the Raffles Museum by fourteen species, of which eleven belong to the genus *Squilla* and the remaining three to the genera *Lysiosquilla*, *Pseudosquilla* and *Gonodactylus*.

The greater part of the material has been collected during the last two years around Singapore Island and in the local fishmarkets. In addition to this, specimens of a number of species were obtained by exchange from the Indian Museum, Calcutta, in 1921, and small collections were made in the South Natuna Islands in 1929 by Mr. P. M. de Fontaine and in Christmas Island, Indian Ocean, in 1932 by the writer. Also the museum is indebted to Mr. W. Birtwistle, Officer-in-charge, Fisheries Department, S. S. and F. M. S., for the gift of a specimen of the rare *Squilla decorata* (Wood-Mason) from Penang.

The richest collecting ground in Singapore is the stretch of shore from Siglap to Telok Kurau on the south coast of the Island.

Here the shore is sandy and shelves very gradually, so that at low spring tides there is a wide area of exposed sand and shallow water. A far greater variety of animals is found in this littoral zone in the south west than in the north east monsoon. This is probably because the more violent wave action that prevails in the north east monsoon drives the littoral fauna to a less disturbed environment in deeper water.

In the fishmarkets Stomatopods are sold for food in relatively small quantities together with prawns and other Crustacea.

In inspecting living and freshly killed individuals it was observed that in the case of the easily confused members of the "*Squilla nepa* group", the colours of the telson and uropods are distinctive and constant in the four species that have been collected, *S. nepa* Latr., *S. oratoria* var. *inornata* Tate, *S. interrupta* Kemp, and *S. wood-masoni* Kemp. These colours have been described rather fully for these species for the benefit of other collectors who have the opportunity of examining fresh material.

In measuring the specimens, the total length is taken as the distance between the tip of the rostrum and the tips of the submedian spines of the telson.

No attempt has been made to give complete synonymies of the species. These will be found in almost all cases in Kemp's monograph on the Stomatopoda of the Indo-Pacific Region, published in the Memoirs of the Indian Museum, IV, 1913.

The writer's acknowledgements and thanks are due to Dr. B. N. Chopra of the Indian Museum, Calcutta, for his kind assistance in working out the material.

Squilla decorata (Wood-Mason).

- 1875. *Clorida decorata*, Wood-Mason, Proc. As. Soc. Bengal, p. 231, reprinted in Ann. Mag. Nat. Hist. (4), XVII, p. 263 (1876).
- 1913. *Squilla decorata*, Kemp, Mem. Ind. Mus. IV, p. 27, pl. i, figs. 13-16.
- 1921. *Squilla decorata*, Kemp and Chopra, Rec. Ind. Mus., XXII, p. 299.
- 1934. *Squilla decorata*, Chopra, Rec. Ind. Mus., XXXVI, p. 21.

A single male from Penang, taken from a fish trap in 4-5 fathoms, presented by Mr. W. Birtwistle, Officer-in-Charge, Fisheries Department, S. S. and F. M. S.

This specimen agrees well with the descriptions and figures published by Wood-Mason¹ and Kemp (l.c.), presenting all the features listed by the latter author which distinguish the species from *S. latreillei* (Eyd. and Soud.).

In Kemp's description the lateral margin of the seventh thoracic somite is described as "produced in front as a sharp

1. Wood-Mason, Figs. and Desc. of nine Squillidæ, p. 9, pl. iv, figs. 14-17 (Calcutta, 1895).

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spine." In the present specimen it is dentiform rather than spiniform, but definitely not rounded as in *S. latreillei*.

The following carinæ end in spines:—

<i>Carinæ</i>	<i>Abdominal Somites</i>
Submedian ..	.. 6
Intermediate ..	.. 4, 5, 6
Lateral ..	.. 3, 4, 5, 6
Marginal ..	.. 3, 4, 5

In this respect, therefore, it agrees with some of the specimens described by Kemp but is definitely at variance with the one recorded by Chopra (l.c.).

The appearance of the upper surface of the telson agrees better with the figure in Wood-Mason's paper of 1895 (l.c. pl. iv, fig. 16) than with Kemp's figure (l.c. pl. i, fig. 15). In the latter figure, which is of a young female, the arrangement of the tubercles in rows is conspicuous, in the former, less so. In the present specimen the tubercles are even more irregularly arranged and all the carinæ are much thickened. Variability in this respect is possibly to be correlated with age, as the present specimen appears to be distinctly larger than any of those previously recorded. The thickening of the carinæ is probably a secondary sexual characteristic, as the males of the closely related *S. latreillei* (Eyd. and Soud.) have the carinæ of the telson thickened and inflated, as noticed by Kemp.

As regards colour the specimen, which was first examined after a few days preservation in formalin, presents no conspicuous features. The ground colour is yellowish white and the sixth thoracic to the fifth abdominal terga are bordered posteriorly with blackish (cf. Wood-Mason, l.c. p. 11), and there are some faint greyish markings on the carapace. The black spot on the eyestalk, just behind the cornea, is distinct. (cf. Kemp, l.c. p. 28).

The total length is 83 mm., the distance between the antero-lateral spines of the carapace, 7.8 mm., and the greatest length and breadth of the telson 14 mm. and 15.7 mm. respectively.

Squilla decorata is previously known from five specimens, all females, and all from various localities in the Bay of Bengal.
Squilla fasciata de Haan.

- 1844. *Squilla fasciata*, De Haan, in Siebold's Fauna Japonica Crust., Atlas, pl. li, fig. 4.
- 1913. *Squilla fasciata*, Kemp, Mem. Ind. Mus., IV, p. 34, pl. 1, figs. 21-23.
- 1921. *Squilla fasciata*, Kemp and Chopra, Rec. Ind. Mus., XXII, p. 300.
- 1926. *Squilla fasciata*, Hansen, Stomatopoda of the Siboga Expedition, p. 5.

One adult male from Siglap, Singapore, July, 1934.

This specimen agrees well with Kemp's description. The shallow grooves on each side of the gastric grooves in the anterior part of the carapace are well marked, and their inner margins are raised into low, slightly pigmented ridges, which are possibly rudimentary representations of the intermediate carinæ, described by Kemp as entirely absent. There is also a short but well marked ridge running obliquely back onto the carapace from the base of each of the antero-lateral spines.

The disposition of the carinæ on the upper surface of the telson is very similar to that shown in Kemp's figure (l.c. pl. 1, fig. 23) except that those which run onto the primary marginal teeth are thickened—a common secondary sexual characteristic of the male in the group of species to which *S. fasciata* belongs. On the ventral side of the telson the inner carinæ on each side of the post-anal carina are well marked, but the outer ones are each represented only by two small, elongate tubercles.

When fresh the specimen had a general reddish tinge, but after a few days preservation in spirit this completely disappeared, except for traces on the raptorial claws. The carinæ, especially those on the sixth abdominal somite and the telson, are rather bright bluish green. The exopodite and endopodite of the uropods are blackish distally, as noted by Kemp (l.c. p. 35).

The total length of the specimen is 74 mm.

***Squilla quinquedentata* Brooks.**

1886. *Squilla quinquedentata*, Brooks, Voy. H. M. S. 'Challenger', XVI, Stomatopoda, p. 26, pl. i, fig. 3, pl. ii, fig. 6.
1913. *Squilla quinquedentata*, Kemp, Mem. Ind. Mus., IV, pp. 52, 195.

Five females and one male from Siglap, Singapore, June-July, 1934.

These specimens agree closely with Brooks' original description and present also the characteristic features mentioned by Kemp. The two dark patches on the median carina of the telson are well marked, as also are a series of brownish areas occupying the median posterior portions of the sixth—eighth thoracic and the first—fifth abdominal terga. In life the teeth of the telson were rose pink and the denticles yellow. In the larger specimens there are some yellow markings at the distal end of the raptorial propodite. The largest specimen, a female, measures 101 mm. in total length. The corneal index (see Kemp, l.c. p. 9) is 5.5 in the largest specimen and 4.8 in one of the smaller ones, measuring 67.5 mm. in total length.

***Squilla scorpio* Latr.**

1825. *Squilla scorpio*, Latreille, Enc. Méth., X, p. 472.
1913. *Squilla scorpio*, Kemp, Mem. Ind. Mus., IV, p. 42, pl. ii, fig. 30.

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A specimen from Singapore, from the Indian Museum, 1921. Ten specimens from Changi and Siglap, Singapore, and from the local fishmarkets.

Squilla scorpio var. *immaculata* Kemp.

1913. *Squilla scorpio* var. *immaculata*, Kemp, Mem. Ind. Mus., IV, p. 45, pl. ii, fig. 31.
1915. *Squilla scorpio* var. *immaculata*, Kemp, Mem. Ind. Mus., V, p. 193.

Two males obtained from a stream in the mangrove swamps near the mouth of the river Jurong, Singapore (Pandan Forest Reserve), October, 1934.

Both the specimens display the distinguishing characteristics described by Kemp, and the larger one differs from equally large males of the typical species in having no thickening of the carinæ of the telson, though Kemp states that the secondary sexual differences are as well marked as in the typical form.

This specimen measures 67 mm. in total length.

Squilla nepa Latr.

1825. *Squilla nepa*, Latreille, Enc. Méth., X, p. 471.
1913. *Squilla nepa*, Kemp, Mem. Ind. Mus., IV, p. 60, pl. iv, fig. 49.
1926. *Squilla nepa*, Hansen, Stomatopoda of the Siboga Expedition, p. 10.

A specimen from Singapore, from the Indian Museum, 1921. Numerous specimens from Siglap, Singapore, the Singapore fish-markets and from Pulau Pisang in the south part of the Malacca Strait.

The colours of the telson and uropods are as follows: Telson dull yellow crossed by a greyish-brown band, punctæ grey. Teeth dull blue, carinæ and denticles rather bright bluish green. Uropods: distal segment of exopodite greenish yellow with an ill defined blackish inner border; proximal segment yellow in the proximal half and dark greenish blue in the distal half. Endopodite yellow, the distal half clouded with dark grey. The proximal part and the larger spine of the bifurcate process yellowish; the smaller spine, and a well defined area at the base of the larger, dark greenish blue.

The species is also characterised by the presence of a dark patch on the second, and on the posterior half of the fifth, abdominal terga.

Squilla oratoria var. *inornata* Tate

1883. *Squilla inornata*, Tate, Tr. Roy. Soc. S. Aust., VI, p. 51, pl. ii, figs. 3a, b, c.
1913. *Squilla oratoria* var. *perpensa*, Kemp, Mem. Ind. Mus., IV, pp. 70, 196, pl. v, figs. 57-59.
1924. *Squilla oratoria* var. *inornata*, Hale, Rec. S. Aust. Mus., II, p. 495.
1926. *Squilla oratoria* var. *perpensa*, Hansen, Stomatopoda of the Siboga Expedition, p. 11.
1934. *Squilla oratoria* var. *inornata*, Chopra, Rec. Ind. Mus., XXXVI, p. 24.

A specimen from Singapore, from the Indian Museum, 1921.

Numerous specimens from Siglap, Singapore, the Singapore fishmarkets and Pulau Pisang in the south part of the Malacca Strait.

One of the characters emphasised by Kemp as distinguishing the variety from the typical form is the interruption of the median carina of the carapace at the base of the anterior bifurcation so that it is "wholly absent for a short space." In the majority of the specimens in the present collection this condition obtains, but quite frequently the discontinuity is incomplete, so that the median carina is in uninterrupted continuity with one of the arms of the anterior bifurcation, and in one specimen there is no discontinuity whatever,¹ so that in this respect the specimen agrees with the typical form. Invariably, however, the dorsal carina of the raptorial carpus is quite typical for var. *inornata*, being entire, and the specimens are undoubtedly referable to the variety.

The colours of the telson and uropods are as follows: Telson greenish above, teeth rose pink, carinæ green, denticles green with pale tips. Uropods: distal segment of exopodite divided longitudinally into inner blackish and outer greenish halves; proximal segment bluish white, the external spines rose pink. Endopodite whitish with some dark clouding distally. Spines of bifurcate process rose pink. Basal segment whitish with greenish carinæ.

Squilla interrupta Kemp.

1911. *Squilla interrupta*, Kemp, Rec. Ind. Mus., VI, p. 98.

1913. *Squilla interrupta*, Kemp, Mem. Ind. Mus., IV, p. 72, pl. v, figs. 60-62.

1926. *Squilla interrupta*, Hansen, Stomatopoda of the Siboga Expedition, p. 11.

A specimen from Singapore, from the Indian Museum, 1921. A specimen collected off Changi, Singapore by N. Smedley in 8-10 fathoms, 31-1-26. Specimens from Siglap, Singapore, June 1934; two specimens from Penang, taken in a fish trap in 4-5 fathoms, presented by Mr. W. Birtwistle, Officer-in-charge, Fisheries Department, S. S. and F. M. S., June 1934.

The colours of the telson and uropods are rather distinctive: Telson light brown with a broad, ill defined, yellow posterior border. A conspicuous chesnut brown spot at the base of the

1. This specimen was examined by Dr. B. N. Chopra, and is mentioned by him in a footnote in his recent paper (Rec. Ind. Mus. XXXVI, 1934, p. 25).

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median carina. Carinæ dull green, teeth rose pink, denticles green with light tips. Uropods: both segments of exopodite and distal part of basal segment lemon yellow. Endopodite greyish white, tip lemon yellow. Bifurcate process yellowish, spines rose-pink.

Squilla wood-masoni Kemp.

1911. *Squilla wood-masoni*, Kemp, Rec. Ind. Mus., VI, p. 99.
1913. *Squilla wood-masoni*, Kemp, Mem. Ind. Mus., IV, p. 74, pl. v, figs. 63-65.
1926. *Squilla wood-masoni*, Hansen, Stomatopoda of the Siboga Expedition, p. 12.

A specimen from Singapore, from the Indian Museum, 1921. Numerous specimens from Siglap, Singapore, the Singapore fishmarkets and from Pulau Pisang in the south part of the Malacca Strait.

The colours of the telson and uropods are brilliant and most distinctive: Telson greenish brown; median carina, olive green, submedian carinæ crimson, other carinæ dull orange. Teeth rose pink, denticles bright orange. Uropods: Both segments of exopodite and distal half of endopodite bright blue. Basal segment whitish, bordered distally with orange. Bifurcate process pale blue, the spines rose pink.

Squilla multicarinata White.

1848. *Squilla multicarinata*, White, Proc. Zool. Soc., p. 144, pl. vi, figs. 1, 1a.
1913. *Squilla multicarinata*, Kemp, Mem. Ind. Mus., IV, pp. 86, 196, pl. vi, figs. 73-76.

Eight males and five females from Siglap, Singapore and from the Singapore fishmarkets, 1933 and 1934. The largest specimen, a female, measures 80 mm. in total length.

Squilla lirata, Kemp and Chopra.

1921. *Squilla lirata*, Kemp and Chopra, Rec. Ind. Mus., XXII, p. 303.
1934. *Squilla lirata*, Chopra, Rec. Ind. Mus., XXXVI, p. 38.

Seven males and nine females from Siglap, Singapore, June 1933, June-July 1934.

In all the specimens the anterior bifurcation of the median carina of the carapace extends from the mid-dorsal pit without any marked interruption. In two, however, the paired carinæ forming the bifurcated part are in contact for a short distance in front of the pit before they diverge, giving the impression at first sight, that the actual bifurcation is anterior to the pit.

Examination of the carinæ between the submedians of the first two abdominal somites show that there is some variation in their development. In the two original specimens only three

such carinæ were found. In two females from the Raffles Museum¹ (which were collected concomitantly with the present series), Chopra found two more incomplete carinæ on these somites, lying on each side of the middle one. In the present series all but four of the specimens have these extra carinæ very slightly developed, being represented in some cases by little more than elongate tubercles on the posterior margin of the somite. In the remaining four, all large females, they are developed more or less as described by Chopra, but are never complete as in *S. multicarinata*, White. In some cases there are in addition small elongate tubercles on the posterior margins of these two somites, just inside the submedians, but these are never sufficiently developed to form carinæ.

The two largest specimens, both females, measure 80.5 mm. in total length.

Squilla raphidea Fabr.

1798. *Squilla raphidea*, Fabricius, Ent. Syst. Suppl., p. 416.
 1913. *Squilla raphidea*, Kemp, Mem. Ind. Mus., IV, p. 88, pl. vii,
 fig. 77.

Numerous specimens from Siglap, Singapore, and from the local fishmarkets, 1933 and 1934.

Pseudosquilla ciliata (Fabr.) ? var.

1787. *Squilla ciliata*, Fabricius, Mantiss. Insect., I, p. 333.
 1913. *Pseudosquilla ciliata*, Kemp, Mem. Ind. Mus., IV, p. 96, 196.
 1926. *Pseudosquilla ciliata*, Hansen, Stomatopoda of the Siboga
 Expedition, p. 17.

A single specimen from Pulau Panjang, South Natuna Islands, collected by P. M. de Fontaine, August 1931.

When this specimen was examined in the first place, it was found to differ in certain respects from the typical form as described by Kemp. It was sent to the Indian Museum, Calcutta, where Dr. B. N. Chopra kindly compared it with the material available there. He found that it differed from the typical form in those respects noted by the writer and in certain minor points as well, and expressed the opinion that if further material presenting the same peculiarities came to hand, there would be justification for separating the form as a variety.

The chief differences are:

- (i) The eyes are shorter than in the typical species, their length being distinctly less than the greatest breadth of the rostrum.
- (ii) The median carina of the telson is strongly sinuous in profile.

The specimen measures 87 mm. in total length.

1. See Chopra, l.c., pp. 38-39.

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Lysiosquilla maculata (Fabr.)

1793. *Squilla maculata*, Fabricius, Ent. Syst., II, p. 511.
1913. *Lysiosquilla maculata*, Kemp, Mem. Ind. Mus., IV, p. 111,
pl. viii, figs. 80-94.
1926. *Lysiosquilla maculata*, Hansen, Stomatopoda of the Siboga
Expedition, p. 18.

A small female from Siglap, Singapore, and two males from
Pulau Panjang, South Natuna Islands, collected by P. M. de
Fontaine August 1931.

The larger of the two males measures 233 mm. in total
length.

Gonodactylus chiragra (Fabr.).

1781. *Squilla chiragra*, Fabricius, Species Insectorum, I, p. 515.
1913. *Gonodactylus chiragra*, Kemp, Mem. Ind. Mus., IV, p. 155.
1926. *Gonodactylus chiragra*, Hansen, Stomatopoda of the Siboga
Expedition, p. 24.

Three specimens from Sultan Shoal, near Singapore, two,
a male and a female presented by Mr. A. Monteiro, 1930, and
a large female collected in December, 1933. A single female
from the west coast of Sumatra, collected in 1897. Six immature
specimens collected by the writer in Christmas Island, Indian
Ocean, August-September, 1932.

Of the varieties separated by various authors, and
summarised by Borradaile in 1907¹, three appear to be
represented in the collection:—

Var. *incipiens*, Lanchester, 1903 (type). The female from
the west coast of Sumatra and five of the immature specimens
from Christmas Island belong here. The larger of the two
received from Sultan Shoal in 1930, a male, is also referable
to this variety. The carinæ of the sixth abdominal segment
are produced into spines, but with strong constriction; the median
carina of the telson carries a rudimentary spine.

Var. *smithi*, Pocock, 1893. The smaller of the two specimens
received from Sultan Shoal in 1930, a female, agrees well with
this variety. The specimen collected from the same locality in
1933, a large female measuring 93 mm. in total length is inter-
mediate between this variety and var. *incipiens* Lanch. The
carinæ of the sixth abdominal segment are compressed and
produced without constriction into long spines, but the median
carina of the telson does not carry a spine.

Var. *anancyrus*, Borradaile, 1900. One of the small speci-
mens from Christmas Island is referred to this variety.

1. L. A. Borradaile, Stomatopoda from the Western Indian Ocean,
Trans. Linnean Soc., Series ii, Vol. XII, 1907-1909, pp. 209-216.

Indo-Malayan Cirripeds in the Raffles Museum, Singapore

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PLATE V

INTRODUCTION

A collection of cirripeds in the Raffles Museum, Singapore was offered me for determination by the Director of the Museum, Mr. F. N. Chasen. For this I wish here to express my best thanks to him and also to the Assistant Curator, Mr. M. W. F. Tweedie for the material sent and the information given.

The collection is of great interest as belonging to a region very rich in cirripeds and also fairly well known because material from this part of the oceans has been collected by several expeditions and also by cable steamers. A paper by Broch (1931) on Malayan cirripeds has recently been published. Also a paper on cirripeds from the same region (the material belonging to the Amsterdam Museum) has been completed by the author and will soon be in print. To avoid repetition of what is mentioned in this paper, I will here be rather brief.

The collection contains in all, as seen from the list here given, 21 different species and subspecies. Of these 12 are already dealt with in my paper above mentioned. One new species *Oxynaspis pulchra* and one new subspecies *Balanus amphitrite rafflesii* may here be registered. Some of the previously known forms have only once before been collected viz. *Heteralepas lithotryae* (Hoek) and *B. amphitrite poecilosculpta* Broch. It would have been of interest to find complementary males of *Sc. persona*, Ann. as none have been found in this species (comp. Nilsson-Cantell, 1931). Even for quite well-known species in the present collection many new localities are given. These localities and some supplementary additions follow in the systematic part. First a list of the species and localities, as well as the depth in metres from which they are taken is given. Some of the specimens of this collection have already been reported on by Annandale (1905 and 1916).

INDO-MALAYAN CIRRIPEDS IN THE RAFFLES MUSEUM

LIST OF THE SPECIES

SPECIES AND SUBSPECIES	LOCALITY	DEPTH IN M.
<i>Pollicipes mitella</i> (Linné)	Gantian, British North Borneo	..
<i>Scalpellum stearnsii</i> var. <i>inerme</i> Annandale	10° 22' 30" S. Lat. 120° 7' 30" E. Long.	238-915
<i>Scalpellum persona</i> Annandale	10° 22' 30" S. Lat. 120° 7' 30" E. Long.	238-915
<i>Scalpellum sociabile</i> Annandale	10° 22' 30" S. Lat. 120° 7' 30" E. Long.	238-915
<i>Lithotrya nicobarica</i> Reinhardt	Christmas Island	..
<i>Ibla cumingi</i> Darwin	Alligator Island, near Singapore	..
<i>Oxynaspis pulchra</i> n. sp.	10° 27' 46" S. Lat. 126° 4' 30" E. Long.	549
<i>Lepas anserifera</i> Linné	Butang Archipelago, Peninsular Siam	..
<i>Heteralepas gigas</i> (Annandale)	10° 22' 30" S. Lat. 120° 7' 30" E. Long.	238-915
<i>Heteralepas japonica</i> (Aurivillius)	10° 22' 30" S. Lat. 120° 7' 30" E. Long.	238-915
<i>Heteralepas lithotryae</i> Hoek	Christmas Island	..
<i>Octolasmis warwicki</i> (J. E. Gray)	Tanah Merah, Singapore; Siglap, Singapore	..
<i>Octolasmisnierstraszi</i> (Hoek)	5° 59' 6" N. Lat. 99° 8' 33" E. Long.	73
<i>Balanus amphitrite variegatus</i> Darwin	Seletar, Singapore	..
<i>Balanus amphitrite cirratus</i> Darwin	Singapore	..
<i>Balanus amphitrite poecilosculpta</i> Broch	1° 26' 3" N. Lat. 102° 58' E. Long.	33
<i>Balanus amphitrite rafflesii</i> n. subsp.	Pulau Sakra near Singapore	..
<i>Balanus amaryllis</i> Darwin	5° 59' 6" N. Lat. 99° 8' 33" E. Long.	73
<i>Balanus ciliatus</i> Hoek	5° 59' 6" N. Lat. 99° 8' 33" E. Long.	73
<i>Tetraclita porosa viridis</i> Darwin	Raffles Lighthouse, Singapore	..
<i>Chelonibia patula</i> (Ranzani)	Raffles Lighthouse, Singapore	..

SYSTEMATIC PART

LEPADOMORPHA Pilsbry

Family SCALPELLIDAE Pilsbry

Genus *Pollicipes* Leach, 1817.

Pollicipes mitella (Linné, 1767).

New locality: Gantian, British North Borneo, 1899.

Distribution: Indo-Pacific.

Genus *Scalpellum* Leach, 1817.

Scalpellum stearnsii var. *inerme* Annandale, 1905. Plate V, fig. 1.

Syn. Nilsson-Cantell, 1921.

Some specimens of Annandale's var. *inerme* of *Sc. stearnsii* are represented in this collection. One very large specimen: length of the capitulum 51 mm., breadth of capitulum 37 mm., length of peduncle 77 mm. and breadth of peduncle 28 mm. is here figured (Pl. V, fig. 1) and agrees well with the specimens figured by Annandale, 1905 Pl. VIII, 1. One specimen is attached to the capitulum of *Sc. persona* Annandale, 1916. To the discussion earlier given (Nilsson-Cantell, 1928) nothing need be added.

Locality: 10° 22' 30" S. Lat., 120° 7' 30" E. Long. *Depth:* 238-915 m. *Bottom temp.:* 13.1° C., Jan. 1884. (Earlier reported on by Annandale, 1905, 1916).

Distribution: Malay Archipelago, Indian Ocean.

Scalpellum persona Annandale, 1916. Plate V, fig. 2.

Scalpellum persona Annandale, 1916, Calman, 1918.

This species is described by Annandale (1916) and discussed by Calman (1918). A superficial resemblance exists between this species and *Sc. alcockianum* Annandale, 1906 in the thick cartilaginous cuticle. To make out the real shape (Pl. V, fig. 2) of the valve this cuticle must be removed. The agreement with the figure given by Annandale (1916, Pl. V, 7) is complete.

Measurements in mm.:

Length of capitulum	..	..	31
Breadth of capitulum	..	..	28
Length of peduncle	..	..	32
Breadth of peduncle	..	..	16.5.

The caudal appendages were twice the length of the protopodite and composed of 15 segments, which is in good agreement with what Calman found (13–16 segments).

Locality: 10° 22' 30" S. Lat., 120° 7' 30" E. Long. *Depth:* 238–915 m. *Bottom temp.:* 13, 1° C. Jan. 1884. One specimen attached to the capitulum of *Heteralcpas gigas*. (Earlier reported on by Annandale, 1916).

Distribution: Malay Archipelago.

Scalpellum sociabile Annandale, 1905. Plate V, fig. 3.

Scalpellum sociabile Annandale, 1905, 1908, Nilsson-Cantell, 1928.

Scalpellum pellicatum Hoek, 1907.

Scalpellum sociabile var. *pellicatum* and *parviceps* (nov.) Annandale 1916, Broch 1931.

One specimen of *Scalpellum* belongs to *Sc. sociabile*, previously discussed by the author (1928). In a paper by Annandale (1916) it appears that he has also studied examples of this species from the same locality and preserved in the Raffles Museum.

Locality: 10° 22' 30" S. Lat., 120° 7' 30" E. Long. *Depth:* 238–915 m. *Bottom temp.:* 13, 1° C. Jan. 1884. (Earlier reported on by Annandale, 1905, 1916).

Distribution: Malay Archipelago, Japan.

Genus **Lithotrya** G. B. Sowerby, 1822.

Lithotrya nicobarica Reinhardt, 1850.

For synonyms see Nilsson-Cantell, 1921 and Seymour Sewell 1926.

In a paper on cirripeds from Bonaire the synonyms of *Lithotrya* species are briefly discussed. (Nilsson-Cantell, 1933). In the above cited paper by Seymour Sewell *L. pacifica* Borradaile, 1900 is with some hesitation taken up as a synonym of *L. nicobarica*. In my opinion (Nilsson-Cantell, 1921) there is no difference between them. The difference in the length of the lateralia is not a character of systematic value. Sewell has given an exact study of several characters, especially the number of the laminae in the capitular valves, here of interest as regards the latera because the length of the latter is due to this. I do not think we have here a character of systematic importance. In younger individuals the number of the laminae is certainly not so high as in older ones. If the latera are broken which is often the case, the number of the laminae is of course smaller.

A comparison of the internal parts is of interest showing good agreement between both species. The number of segments of the cirri and the caudal appendages as given by Nilsson-Cantell 1921, p. 221 and Seymour Sewell 1926, p. 307 is of special

interest as both authors state the size of the individuals examined. As seen from the tables the agreement is very good. The same is proved by comparison with the specimens of the collection here dealt with.

New locality: Christmas Island, Indian Ocean, Oct. 1932.

Distribution: Malay Archipelago, Indian Ocean, Oceania (New Zealand, Fiji, Paumotu Islands). Certainly the species must occur around many islands of the Pacific Ocean. The locality here given is the most southerly in the Malay Archipelago. The most eastern locality in Oceania is Paumotu Islands, given by Pilsbry for *L. pacifica*, 1907.

Fam. IBLIDÆ Annandale, 1909.

Genus *Ibla* Leach, 1825.

Ibla cumingi Darwin, 1851.

Syn. Nilsson-Cantell, 1921.

New locality: Alligator Island, near Singapore, April, 1933.

Distribution: Red Sea, Indian Ocean, Malay Archipelago, western part of the Pacific Ocean.

Fam. OXYNASPIDÆ Gruvel, 1905, (Pilsbry, 1907) Nilsson-Cantell, 1921.

Genus *Oxynaspis* Darwin, 1851.

Oxynaspis pulchra n. sp. Text-fig. 1.

Diagnosis: Capitulum with five white valves with growth-lines and chitinous spines. The colour of all chitinous parts brown. Scutum relatively reduced, with subcentral umbo, nearly rhomboidal with carinal and basal margin somewhat concave. Tergum approximately triangular with occident margin convex. Carina with nearly basal umbo, above this regularly arched; below the umbo the carina divides in a furca. Pedunculus narrow with chitinous spines. Labrum with teeth. Caudal appendage absent as also lateral and dorsal filaments. Inside of cirrus I with a protuberance and at the base of this a boss, both with small chitinous projections.

Description: A very interesting find of a pedunculate cirriped from a telegraph cable must here be noted as it is a representative of the little known genus *Oxynaspis* and also represents a new species quite distinct from those earlier known. Previously the following 7 species have been described: *Oxynaspis celata* Darwin, 1851 with the forma *indica* Annandale and *japonica* Broch, 1921, *O. patens* Aurivillius, 1894, *O. aurivillii* Stebbing,

INDO-MALAYAN CIRRIPEDS IN THE RAFFLES MUSEUM

1900, *O. bocki* Nilsson-Cantell, 1921, *O. terrae-novae* Totton, 1923, *O. connectens* Broch, 1931, *O. pacifica* F. Hiro, 1931. In all therefore 8 species of this genus associated with anthipatharians and sponges are now known, a small number in comparison with another pedunculate genus, *Scalpellum*. Certainly the genus *Oxynaspis* in reality contains only a few species.

Of the new species only one specimen has been collected, on which the description below is based. For the genus it is typical that the peduncle and capitulum is covered by small spines of the same appearance as those found on the anthipatharian. By several authors this is said to be caused by the over-growing of the horny and spiniferous bark of the anthipatharian. The fact of the soft parts growing over the barnacle is stated by Broch (1921) for *O. celata* f. *indica* as polyps also are situated on the capitulum of the cirriped. Yet we find in the literature opinions for and against this. Several authors, as for instance Aurivillius, who has studied *O. patens* is of the opinion that the spines are formed by the cirriped. Annandale too (1909) holds a similar opinion, but later (1914) the same author has given up this opinion. I have also myself from the study of specimens of *O. bocki* and *O. aurivillii*, said that the spines certainly belong to the animal. Totton, for *O. terrae-novae* has affirmed that the anthipatharian has given off small branches over the cirriped. It was thus of great interest that Broch (1931) found a n. sp., *O. connectens* that does not live imbedded in coral but is fixed on a silicosponge. For the other species taken from coral he ascribes to the cirriped the fine horny layer next to the plates as well as the small (internal parts of the) spines; only the outer layer covering this fine cuticle is due to the anthipatharian (Broch, 1931 p. 37). It is interesting here to compare the new species in this collection with the others in this regard. As only a single specimen has been found no thorough study is possible. As far as I can see, the spines on the cirriped seem to belong to the cirriped. But this does not exclude the possibility of the whole cuticle being covered by a layer of the anthipatharian. The full elucidation of this problem is a rather difficult matter for which richer material of the different species is necessary. But I do not think I am wrong if I say that in different species this covering is more or less rich. *O. celata* is more imbedded by the coral than e.g. the present new species *O. pulchra*, *O. connectens* and *O. bocki*. Without making any particular new contribution to this question, much written about, I merely wished to touch upon the question in giving the description of this new species. Other characters for this species are of more specific value, well separating the species from the related *O. connectens* Broch, 1931.

The capitulum has five valves which are of a white colour. They are covered by a thin cuticle which is not so thick as in *O. connectens*, while the valves have not the brownish hue characteristic of that species. The growth-lines of the valves are distinct and regularly arranged.



Text-fig. 1. *Oxynaspis pulchra* n. sp.

a. Holotype, lateral view. b. Carina, lower part. c. Labrum. d. Palpus. e. Mandible. f, g. Maxilla I. h. Maxilla II. i. Inside of Cirrus I with protuberance. j. Top of the protuberance magnified.

The tergum is approximately triangular with the occludent margin convex. The basal margin is nearly straight. The carina in the upper part is concave, in the lower more convex. Umbo apical.

The scutum is of the typical shape and not reaching to the carina as in *O. connectens*. It is quadrangular. The occident margin above the subcentral umbo is straight. Below this it is more hollowed out. The tergal margin is straight, about half the length of the occident margin. The carinal margin is concave like the basal margin which is also a little irregular. The corners of this plate are rounded. The scutum is thus somewhat similar to that of *O. aurivillii* but quite unlike in finer details. There is also a less marked agreement with the scutum of *O. terrae-novae*, which species in many other characters, especially the carina, is distinct. It is not possible to regard this specimen as a variety of *O. connectens* with reduced scutum. Differences from this species are numerous, as I have seen by a study of Broch's type specimens.

The carina is regularly arched above the nearly basal umbo. The part below the umbo is formed as a furca. In this it almost agrees with *O. bocki* which however in other characters is different. The carina of *O. connectens* has a lower more flattened "plateshaped part with an attempt at forking." Broch's species, *O. connectens*, is, as seen by studying the type specimen, in the carina more like the species *O. celala* and *aurivillii* than the species *O. bocki* and the present new species, both of which have a distinctly forked carina.

The capitulum of this new species has a part free from the capitular valves. On this part as on the valves there are small spines more or less distinctly arranged in concentric lines.

The peduncle is relatively narrow with the above-mentioned small spines. The lower part is grown round the axis of the antipatharian, which axis is seen through the covering tissue. The colour is brown. I do not think this part of the specimen offers any character of specific value.

Measurements of the holotype in mm.:

Length of capitulum	..	..	12
Breadth of capitulum	..	..	6
Length of peduncle	..	..	9.5
Breadth of peduncle	..	..	2

Mouth-parts: The labrum is, as found in other representatives of this genus, prolonged, tongueshaped and hollowed out, not much pointed at the top. Fine denticles are present arranged in a semi-circular row as found in *O. bocki* and *O. aurivillii*. No denticles are mentioned for *O. connectens* Broch, 1931.

The palpus is conical but rather blunt, with bristles.

The mandible has three strong teeth with the upper margin pectinated. Below these there are two smaller teeth divided into

still smaller ones like the acute lower angle. In the other species the lower teeth are better developed than here. The number of teeth is not the same in all species.

The maxilla I. shows variation in the same specimen. The one maxilla has a broad notch below the upper spines, of which the first is the strongest. The lower part of the front edge has strong teeth paired as often is the case in cirripeds. The lower angle is distinctly marked and provided with small spines. The maxillae of the other side has a rather indistinct notch. The maxillae thus offer no important character of specific value. Broch (1922) found a similar variation in maxilla I. of *O. celata*.

The maxilla II. is of the typical shape for the genus *Oxynaspis* with a straight front edge. Bristles are placed in a continuous row along the front and upper margin.

Number of the segments of the cirri:

	I	II	III	IV	V	VI
Holotype						
	7	9 12 13	15 15	15 15	15 15	15 16

Cirrus I. is shorter than and separated from the others. The longer cirri have 5 pairs of bristles on the front edge of the segments. Of special interest is the first cirrus in comparison with the description of *O. terrae-novae* given by Totton (1923). He describes on the inside of each proximal segment of the protopodite of this cirrus a protuberance with short spinules, not described in detail, and between the bases of the same cirri two conical bosses with spinules not mentioned for any other species of this genus. This new species seems to agree in this respect with *O. terrae-novae*. Both the protuberances as well as the bosses are found here. But as no detailed study has been made of the spinules in *O. terrae-novae* no comparison is possible in particulars. Perhaps there exists a dissimilarity in this respect. Both appendages in the specimen of the present collection have small protuberances of typical shape as seen from the figure. The small spinules seem to have a fine central channel with the opening at the top of the small cone. The function of this peculiar formation is difficult to decide. In Broch's species *O. connectens* which is described in great detail, these appendages are not mentioned. But a filamentary appendage is found at the outside of the base of each cirrus I. in both the above-mentioned species. A careful examination of the specimen here described revealed no such filamentary appendage. For the other species these filamentary appendages are not originally described. But Totton (1923) has

found them on material of *O. celata*. Perhaps there exist variations in this respect so that some species have them and some not. Also as regards the presence of dorsal filamentary appendages there seems to be variation. Broch in *O. connectens* found a single one in the median dorsal line and Totton in an unnamed species found two such dorsal appendages. In this new species I found none. For other species of *Oxynaspis* they are not mentioned.

The penis is of the typical shape.

The caudal appendages are not developed.

Locality: 10° 27' 46" S. Lat., 126° 4' 30" E. Long. *Depth:* 549 m. From a telegraph cable. 28-7-1913.

Discussion of the phylogeny of the genus.

A question of great interest, but always difficult to wholly clear up, is that of the phylogenetical affinities of a genus. Darwin was the first to offer some phylogenetical reflexions on the cirriped genera, including this genus. Later on discussions were propounded by Broch (1922, 1931), Nilsson-Cantell (1921, 1925) and Withers (1928). I cannot say that the authors mentioned wholly agree in this respect, but I think the difference in results is partly due to our rather incomplete knowledge of the species of this genus. Thus I think that what Broch (1931) says about my reasoning on this question: that it is "based on rather subjective sentiments" is typical for the reasoning of all authors who try to solve a question of so great difficulty. I will not in the following try to add much to what has already been said about the genus but only point to some facts of interest in this regard.

On my first study of this genus (1921) the internal parts, especially the filamentary and other above-mentioned appendages, were not known. I based my reasoning on a study of the mouth parts and naturally also the capitular valves. It is difficult to give up the phylogenetic connections of *Oxynaspis* and other pedunculate genera. After a study of the mouth parts I stated (1921) that the genus in these parts agrees with *Scalpellum* and *Trilasmis* (*Poecilasma*) and I will now add related genera e.g. *Octolasmis*. It is interesting to find that Broch also in other parts of the body e.g. the valves and filaments of a newly described species (1931) finds affinities with *Trilasmis* (*Poecilasma*) and the allied *Megalasma* with the subsp. *Glyptelasma* and *Megalasma*. But I do not think it is suitable to take up such different genera as *Lepas*, *Heteralepas*, *Oxynaspis* and *Trilasmis* and unite them under the same family as done by Broch (1931).

The different species of *Oxynaspis* agree in several characters, so there will be no hesitation in deciding whether a species is an *Oxynaspis* or not, but in the finer anatomical details there are considerable differences between the species. It seems to me that this phylogenetically rather old genus among the five-valved pedunculates is related to many genera. Like some other authors I have (1921) taken up the genus *Oxynaspis* as a separate group, and regarded it as a family. If we wish to try to group the pedunculates in series of related genera regarded by me as families we must keep the genus apart from e.g. the genus *Ibla* and the natural series *Lepas*, *Conchoderma*, *Alepas* and *Anelasma*, and further the series represented by *Trilasmis* (*Poecilasma*), *Octolasmis*, *Megalasma*, etc., and the group of *Heteralepas* with its two subgenera *Heteralepas* and *Paralepas*. For the discussion of this grouping I must refer to Nilsson-Cantell (1921) and the discussion given by Withers (1928). In my study of the phylogeny of the pedunculates I have avoided any assertion of the genus from which a genus is derived. If we study the literature we shall find rather different opinions on this difficult question. Broch (1922) derives the genus directly from *Trilasmis* (*Poecilasma*), Withers from a more paleontological and also morphological point of view from a *Scalpellum*-like barnacle. *Trilasmis* (*Poecilasma*) and *Lepas* are in his opinion descendants from *Oxynaspis*.

It may here be of interest to comment on the interesting discovery of *O. connectens* which shows a "curious intermingling of characters from different genera" (Broch, 1931 p. 37). After studying my new species *O. pulchra*, as well as other earlier known ones, I should like to express my opinion about the whole genus in the words cited above from Broch. From a study some years ago of the *Oxynaspis* in the British Museum, London, I came to the opinion that some species of *Oxynaspis* show a superficial resemblance to some *Octolasmis* species for instance *O. sessilis*. This will perhaps speak for a connection with the genera *Trilasmis* and *Octolasmis*. But other species e.g. *O. celata* also show a relation to *Scalpellum* a fact first pointed out by Darwin.

If we study the 8 now known species we cannot say that in the capitular valves they wholly agree as e.g. in the position of the umbo. The terga of the different species agree fairly well which is the case in nearly all pedunculates. The scuta represent in the various species different stages of development. As regards the situation of the umbo of the scutum it varies from nearly central to subcentral but is in no case basal. The carina in *Oxynaspis celata* has the umbo nearly central. Below the umbo there is a plate-shaped part not much forked. In the

species *O. patens*, *terrae-novae*, *aurivillii* and *pacifica* the umbo is subcentral and the lower part is very similar in shape to that in *O. celata*. In *O. aurivillii* there is already the beginning of a furca in the carina. In *O. bocki* there is a carina more agreeing with the *Trilasmis*—*Octolasmis* series. Thus the umbo is nearly basal. The part below the umbo is forked. In this character *O. pulchra* n. sp. is associated. As regards Broch's *O. connectens* I was first doubtful if as regards the carina it should be put in the first or second group as the carina shows according to Broch "an attempt at forking." But by a study of the type specimen I was led to include it with the former. The species name *connectens* is also in this regard well found as the carina, with its nearly basal umbo but flattened lower part, links the two types together. Also this speaks in favour of an opinion that the genus though only comprising a few species is rather split. As regards the internal parts our knowledge of the filamentary appendages is incomplete. But the filamentary appendages at the base of cirrus I. seem to be present in *O. celata* (according to Totton, 1923), *terrae-novae* and *connectens*. In the new species, *O. pulchra*, they are not found as is also the case in *O. bocki*, *aurivillii* and *pacifica*. Certainly this appendage is not developed in all species. In the genus *Lepas* for instance some species have many filamentary appendages, others only one or none. The differences in the appendages between the species of *Oxynaspis* do not support the division into two groups here made from a study of the carina only. These groups in my opinion certainly do not represent subgenera. The bosses and protuberances on the inside of the first cirri are only seen in the species *O. terraenovae* and *O. pulchra* n. sp. They may have been overlooked in some of the other species, but their presence in representatives of the two mentioned groups unites those in this regard. The discovery of dorsal filamentary appendages (one in *O. connectens* and two in an unnamed species mentioned by Totton, 1923) points, according to Broch to affinities with *Megalasma*. But these appendages are not, as was mentioned above, present in the species in the present collection. We thus see that it is very difficult to come to a general conclusion about the phylogeny as it is not possible to draw any definite conclusion from this analysis. Nevertheless it has been of interest to point out some facts which will perhaps give directives for further studies on richer material. My earlier diagnosis of the family *Oxynaspidae* needs revision, which will be left until more is known of the different species.

Addition: Some days before this paper was sent to the printer I got an interesting paper on two new Japanese cirripeds by F. Hiro (1933), which paper will be of great interest in this connection, as it contains a discussion of phylogenetical problems

of pedunculate cirripeds. Much in this paper speaks for the opinions pronounced by me in my earlier papers. The view of F. Hiro on the genus *Oxynaspis* may here be cited: (p. 243) "Of the pedunculate cirripeds, the *Lepadidae* (s. str.) which have naked peduncles, are considered to have been derived from the Scalpellid group by the loss of the lower lateral valves of the capitulum and the scales of the peduncle, through *Oxynaspis* which is regarded as the more ancient form of the *Lepadidae* (s. str.)" and (p. 244) "Obviously, this *Oxynaspis*, or its allied forms, has given rise on the one hand to the recent *Poecilasma* and *Lepas* which have the valves wholly calcified and the umbones of the scutum and carina basal in position, and on the other hand to such forms as *Conchoderma* and *Alepas*, in which the valves are decalcified and degenerate, but the umbo of the scutum remains subcentral. It is noteworthy in this case that *Poecilasma* and *Lepas* have no doubt arisen independently, since, although externally they are similar to each other, internally *Lepas* is decidedly more related to *Conchoderma* and *Alepas* than to *Poecilasma*." As I have also pointed out above there must be a connection between the genera *Scalpellum*, *Oxynaspis*, *Trilasmis* (*Poecilasma*) and the allied *Octolasmis* and *Megalasma*. It may be possible that *Oxynaspis*, which genus, as treated above in this paper, is rather split though only comprising a few species, has given rise to such different series as *Trilasmis* (*Poecilasma*) and allied forms and *Lepas* and its allies. But as we know too little of the fossil forms of these genera especially *Oxynaspis*, I have preferred as in my earlier papers not to construct a phylogenetical tree, which must always be a rather dubious thing.

Above I have, as in my earlier papers (1921 and 1925), pointed out that it seems not to be suitable to take up such different genera as *Lepas*, *Hetcralepas*, *Oxynaspis*, *Trilasmis* and allied genera under the same family as done by Broch (1922 and 1931). In this paper by F. Hiro p. 244 a similar opinion, which may be cited, is found: "Broch (1922) also is rather against the view that the *Lepadidae* (s. str.) should be split up into small groups. But it seems to me advisable to subdivide the family, to consider the phylogenetic relationship of the different forms included in it."

Family LEPADIDAE (Darwin) Nilsson-Cantell.

Genus *Lepas* Linné 1767.

Lepas anserifera Linné, 1767.

New locality: Butang Archipelago, Peninsular Siam, 1911.

Several typical specimens with 6 filamentary appendages on cirrus I.

Distribution: Pelagic in tropical and temperate seas.

Family HETERALEPADIDAE Nilsson-Cantell, 1921.

Genus *Heteralepas* Pilsbry, 1907.

***Heteralepas (Heteralepas) gigas* Annandale, 1905.**

Alepas gigas Annandale, 1905.

Heteralepas gigas Annandale, 1916.

This species, characterized by its large size, is here represented by a specimen from the same locality as given by Annandale (1916), who also has studied similar specimens from the Raffles Museum. It is indeed a difficult thing to make out if all the species of the genus *Heteralepas* are good ones. Regarding this one it is possible that it only represents older specimens of another earlier known species. But because it is possible to identify Annandale's species there is no reason not to regard it as a separate species. To the description of the internal parts given by Annandale (1905) nothing need here be added.

Locality: 10° 22' 30" S. Lat., 120° 7' 30" E. Long. *Depth:* 238-915 m. *Bottom temp.:* 13.1° C. One specimen together with *Sc. persona*. (Earlier reported on by Annandale, 1905, 1916).

Distribution: Malay Archipelago.

***Heteralepas (Heteralepas) japonica* (C. W. Aurivillius, 1894).**

Syn. Nilsson-Cantell, 1927.

Several specimens of the genus *Heteralepas* must in my opinion be referred to *H. japonica*, a species critically studied as regards synonyms by the author (1927). In the long peduncles the individuals agree with the forma *indica* of *japonica*. Concerning this species there is a study by Nilsson-Cantell (1927, p. 756): "*H. indica* is therefore only included here as a forma *indica* of *japonica*, and then concerns individuals with long peduncle. Possibly this variation need not be specially treated of in a future revision."

An examination of the internal parts shows, as stated by the author (1929), that the supposed difference between *H. japonica* and *indica* in the number of segments of the shorter rami of cirrus V. and VI. is not sufficient to distinguish those species.

Locality: 10° 22' 30" S. Lat., 120° 7' 30" E. Long. *Depth:* 238-915 m. *Bottom temp.:* 13.1° C. This locality is already noted by the author 1927 for specimens in the Netley Hospital collection.

Distribution: Japanese-Malayan waters, Indian Ocean (eastern and western parts).

Heteralepas (Paralepas) lithotryae (Hoek, 1907). Text-fig. 2.

Alepas lithotryae Hoek, 1907.

Discussion and supplementary description: The subgenus *Paralepas* of the genus *Heteralepas* is well defined from the subgenus *Heteralepas* by the shape of the cirri. Several species of the former subspecies have now been described. Their identification seems to offer considerable difficulty as the differences are not very great. It must thus be rather doubtful if all are good species, described as they are from one or few specimens. But I think it is better to follow Broch who, with some hesitation, has described (1922) 4 new species on rather small differences, than to try to rank them under earlier known species, which will obscure further identifications. In this collection there was a small *Heteralepas* specimen situated on the scutum of a *Lithotrya nicobarica* from the Malay Archipelago. The specimen in the present collection agrees well with a specimen also from *L. nicobarica* from the same region, which is described by Hoek (1907) under the name *Alepas lithotryae*. As pointed out by the author (1927) this species belongs to the subgenus *Paralepas*. In the following supplementary description reasons for this determination are given.

The fact that both Hoek's specimens and this one are taken from *L. nicobarica* in Malayan waters suggests that they possibly are identical, as no other *Paralepas* have been taken from that substratum.

As in Hoek's specimen there is no well-defined limit between the capitulum and the peduncle, as seen from the figure here given. The figure given by Hoek is not quite similar to mine here, but this may be due to differences in contraction of the musculature by the preservation or to differences in age. No carinal crest is to be seen. The orificium is extremely narrow, as in the type, and not protuberant. No scuta are present but they are indicated in the chitin. The carinal margin of the capitulum is strongly bowed. The occludent border is a little convex beneath the orifice. In Hoek's specimens the surface has a reticulation of delicate striae not seen in my specimen which has a smooth cuticle, certainly this is also a character due to contraction of the animal. The peduncle is here of about the same length as the capitulum without any well-defined limit. As seen from the figure (Text-fig. 2) there is a slight longitudinal depression on the peduncle and a similar one between capitulum and peduncle due to contraction during preservation.

Measurements of the specimen in mm.:

Length of capitulum	..	..	4
Breadth of capitulum	..	..	4
Length of peduncle	..	..	4.5
Breadth of peduncle	..	..	3.3



Text-fig. 2. *Heteralepas (Paralepas) lithotryae* (Hoek, 1907).

a. Specimen, lateral view. b. Labrum with palpi. c. Mandible.
d. Maxilla I. e. Maxilla II.

As will be seen the type specimen is much smaller, the largest measuring only 4.5 mm. in total length. Perhaps in these small specimens the peduncle has not attained its normal shape.

Internal parts: A study of the mouth-parts and cirri give good agreement. But as the preservation of the interior of the animal was not very good I was not able to compare the filamentary and caudal appendages nor the penis, which parts are well-known according to the type description.

The labrum has small chitinous teeth and delicate hairs.

The palpus is short and conical with bristles along the margin and at the tip.

The mandible has three teeth and a tooth-like inferior angle. The small spines mentioned by Hoek along the upper margin of teeth 2 and 3 as well as the upper margin of the inferior angle are also found here. Also along the lower margin of the same teeth small additional teeth are placed.

The maxilla I. has two strong spines above the rather distinct notch, with few hairs. Below the notch there are strong spines arranged in double rows. Earlier I have discussed the differences between the mouth-parts of different genera of cirripedia. In this study I have found that the maxilla I. of these two subgenera are slightly different, *Heteralepas* having the lower part more prominent than *Paralepas*, but it can also be stated that the differences are not so important in this respect as there are sometimes transitional forms between the two. Broch also mentions (1922) two types: The subgenus *Heteralepas* with the notch more distinct and the subgenus *Paralepas* with a small or rudimentary notch, the differences being due to the more or less projecting lower part of the front margin of the maxilla. In the species *H. lithotryae* and *H. dubia* Broch, 1922, of the subgenus *Paralepas* the notch is broad and the lower part projecting as in the subgenus *Heteralepas*. This shows that as regards the maxillae there are no great differences between these subgenera, which are however in other respects well separated.

The maxilla II. has the front edge straight to convex with a continuous row of long spines continuous with the spines on the rounded extremity and the front part of the upper margin.

Number of segments of the cirri:

I	II	III	IV	V	VI	Caudal appendage
6	6	7	8	8	7	8

The cirri are extremely short and in this species nearly straight as asserted by Hoek. The first pair shorter than the following agreeing in details with the original description. The

following cirri have nearly equal rami. The distal segments have strong clawlike spines of importance for catching the food, because the cirri from their shortness are unsuitable. As in the type specimens the cirri V. and VI. are shorter than the foregoing. The caudal appendages in the specimens of this collection were lost. According to Hoek they are a little longer than the pedicel, having five segments. The penis is also lost but has, according to the original description, spines of peculiar shape.

According to Hoek the type specimens were attached to the valves (Text-fig. 2) even on their inside, thus being a source of inconvenience to the host. This specimen was placed on the outside of the left scutum near to the orificium, a good place indeed for catching the planktonic food of the *Lithotrya*.

Hoek speaks about the relation of this species to *Heteralepas quadrata*, but since the revision of the old genus *Alepas* by Pilsbry this does not hold good as *H. lithotryae* is a typical *Paralepas* and *A. quadrata* a typical *Heteralepas*.

New locality: Christmas Island, Indian Ocean, Oct. 1932.

Old locality: 2,700 m. N. 185° E. from south point of South Lucipara Island.

Family TRILASMATIDAE n. nom.¹

(= fam. *Poecilasmatidae* Annandale, 1909, Nilsson-Cantell, 1921).

Genus *Octolasmis* Gray, 1825.

Octolasmis warwicki (J. E. Gray, 1825).

Syn. Nilsson-Cantell, 1928.

During a study of a large collection of Cirripeds belonging to the Amsterdam Museum much material of *O. warwicki* from several localities in the Malay Archipelago was registered. In a paper by the author on this material, not yet in print, the question whether *O. warwicki* and *O. nierstrassi* are good species is discussed. As it is possible to distinguish them, especially by the rather different shape of the terga, they must be kept as distinct species.

One specimen from the cheliped of a living *Portunus pelagicus* may be noted as it is one of the largest I have seen, measuring in the length of capitulum 10 mm., in breadth of capitulum 7 mm., in length of peduncle 2.5 mm. and breadth of peduncle 3.5 mm.

1. According to Pilsbry (1928) the genus name *Poecilasma* is rejected and the older name *Trilasmis* taken up. Consequently the family name must be changed to *Trilasmatidae*.

New localities: Tanah Merah, Singapore, 1909. The specimens were found attached to a crab.

Siglap, Singapore, June 1933. One specimen on the cheliped of *Portunus pelagicus*.

Distribution: South China Sea to Indian Ocean.

Octolasmisnierstrassi (Hoek, 1907).

Syn. Nilsson-Cantell, 1927.

New locality: 5° 59' 6" N. Lat., 99° 8' 33" E. Long. *Depth:* 73 m. *Bottom temp.:* 25° C. *Bottom:* Dark gray mud.

Specimens are attached to a red alcyonarian and to *Balanus ciliatus*.

Distribution: Malay Archipelago, Persian Gulf, Japan.

BALANOMORPHA Pilsbry

Family **BALANIDAE** Gray.

Subfamily **BALANINAE** Darwin.

Genus **Balanus** da Costa, 1778.

Subgenus **Balanus** da Costa.

Balanus amphitrite variegatus Darwin, 1854.

This species, originally described from specimens from New Zealand, recurs and is discussed in the afore mentioned paper by the author on Malayan cirripeds, which is not yet in print. Hoek also mentions in the Siboga expedition specimens of *B. amphitrite* showing resemblance to *variegatus*. The most typical character is the violet coloured narrow stripes on the shell crossed by white bands. This variety is rather near to *B. a. cirratus*, though the colouring is different.

There are also in the opercular valves no great differences in these subspecies. In the specimens dissected I found on the scutum a distinct but short adductor ridge. The spur of the tergum is rather elongated as in *cirratus*, in some specimens it is pointed, in others more truncated. The opercular valves of *B. a. variegatus* from the Malay Archipelago will be figured in the above mentioned paper of mine.

New localities: Seletar, Singapore. Specimens on *Ostrea* shells. Singapore. Littoral. Specimens on mussel shells.

Distribution: New South Wales, New Zealand, Malay Archipelago.

Balanus amphitrite cirratus Darwin, 1854.

This subspecies has been discussed by the author in several papers (Nilsson-Cantell, 1921, 31 b, 32), and is here represented by one specimen, pale in colour, thus agreeing with some specimens from China (Nilsson-Cantell, 1931 b) and some other smaller specimens of the typical purplish brown colour. The opercular valves of the specimens are exactly like those figured by the author (Nilsson-Cantell, 1921, Text-fig. 65 c, d).

New locality: Singapore. Littoral. Some specimens situated on a mussel shell together with *B. a. variegatus*, other smaller ones on wood.

Distribution: Mouth of Indus, Further India, Sunda Islands, Philippines, China and Australia.

Balanus amphitrite poecilosculpta Broch, 1931, Plate V, fig. 4, Text-fig. 3, 4.

Some specimens of a *Balanus* situated on a gorgonian stem agree wholly with the recently described forma *poecilosculpta* of *B. amphitrite*. If we wish to avoid the trouble which is caused by the great difficulty in identifying the many subspecies of *B. amphitrite* it is necessary to give figures especially of the opercular valves. In studying the collection of the Siboga expedition in Amsterdam, one must note that many rather different forms are included in the two varieties *communis* and *malayensis* of Hoek. If consequently for instance a specimen is taken up under the name *B. amphitrite malayensis* and no figures of the opercular valves and the shell are given it is not possible for later investigators from the literature only to know the exact appearance of the specimen. To avoid mistakes figures are here given showing the entire agreement with those given by Broch. In the Siboga material I have seen specimens rather like these but ranged under *B. a. malayensis*. Another species, *B. minutus* Hoek, 1913, re-identified by Broch, 1922 and Nilsson-Cantell, 1925, is rather like *B. a. poecilosculpta* but well distinguished by the shape of the opercular valves. Perhaps *B. minutus* is only a Malayan form of *B. amphitrite*, an opinion expressed by Broch, 1922, p. 320.

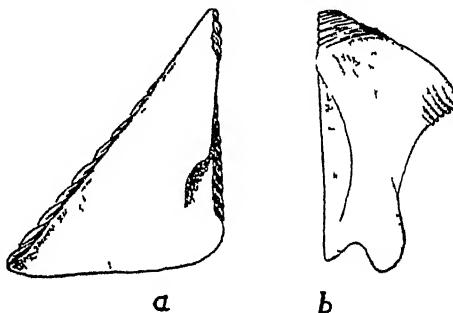
In the individuals here dealt with the shell is laterally compressed. The specimens, which are fixed on a rather thin gorgonian stem, have consequently the bases externally concave taking their form from the substratum.

Measurements of some specimens in mm.

<i>Carino-rostral length</i>			<i>Height</i>
6	..	..	.. 4.5
5	..	..	.. 5.1
7	..	..	.. 5.5

These specimens are thus smaller than those studied by Broch, who mentions a carino-rostral length of 10 and 8 mm. respectively. As I found eggs in initial development the specimens are mature. This form certainly attains no large size.

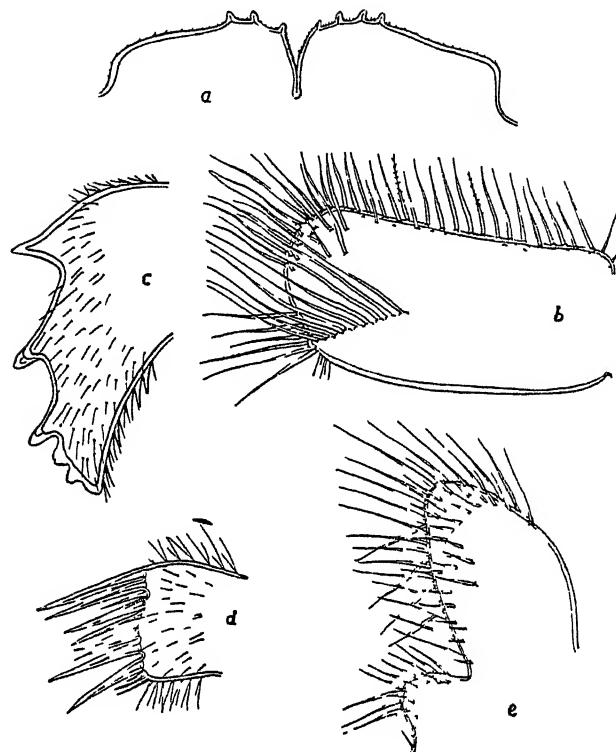
The markings on the shell are rather typical, as seen from the photographs here given, showing good agreement with Broch's figure. The compartments are porous like the basis, a condition typical for all species belonging to this section of *Balanus*. The radii are exceptionally broad, sometimes coloured in the same way as the compartments. The opercular valves agree completely with the figures given by Broch as seen from text-fig. 3 which is exactly like a copy of Broch's. The scutum has only a weak indication of an adductor ridge, otherwise internally no sculptures.



Text-fig. 3. *Balanus amphitrite poecilosculpta* Broch, 1931.

a. Right scutum. b. Right tergum

Internal parts: The mouth-parts may here be described and figured. The labrum has according to Broch three teeth on each side of the notch. On dissecting two specimens I found in one 3 teeth on one side and 4 on the other, in the second specimen 4 teeth on each side of the notch. Variation in this respect is rather common in several species of *Balanus*. The palpus is typical, being clubshaped.

Text-fig. 4. *Balanus amphitrite poecilosculpta* Broch, 1931.

a. Labrum. b. Palpus. c. Mandible. d. Maxilla I. e. Maxilla II.

The mandible and the maxillae are of the common type, as stated by Broch. In maxilla I. I found in these specimens a small hardly distinguishable notch. Figures are given for comparison.

Number of segments of the cirri:

Size	I	II	III	IV	V	VI				
Carino rostral length 5 mm.	9	13	10	11	10	11				
Height 5.1 mm.	19	21	23	24	25	26

As no notes are given in the original description concerning the numbers of segments a comparison is impossible. But I believe there is no great difference in this respect. The armature

of the third cirrus mentioned by Broch is here also traced. The longer cirri have 3 pairs of strong spines and sometimes a fourth pair of very small spines on the front edge of the segments.

New locality: 1° 25' 3" N. Lat., 102° 58' E. Long. *Depth:* 33 m. *Bottom temp.:* 21° C. *Bottom:* Grey mud. The specimens were collected on cable from C. S. "The Cable". 11-2-33.

Distribution: Malay Archipelago, South China.

Balanus amphitrite rafflesii n. subsp. Plate V, fig. 5, 6, Text-fig. 5, 6.

Diagnosis: Shell originally smooth with longitudinal violet stripes, without horizontal bands. Older specimens more corroded without stripes and of a gray colour. Radii well developed with oblique summits, in older specimens more oblique due to denudation. Compartments well calcified, remarkably thick. Scutum with a strong articular ridge and adductor ridge extending from the apex over a large part of the valve. Cavity for the adductor muscle deep. Below the adductor ridge there are two smaller ridges, the lower near to the very indistinctly marked pit for the lateral depressor muscle. Tergum externally with a slight broad longitudinal furrow. Spur well developed, rounded. Labrum with four teeth, the first placed in the notch. Maxilla I. without distinct notch below, not much projecting. Cirrus III. with small teeth on the front edge of the segments. Longer cirri with four pairs of spines on the front edge of the segments.

Description: Some specimens of a *Balanus* situated on mangrove from Pulau Sakra, near Singapore seem on a superficial examination not to belong to any of the already described subspecies of *B. amphitrite*, to which species they belong as seen on an examination according to the key given by Pilsbry (1916). After a more careful study of them I must regard them as a new subspecies as they do not agree with any other known subspecies. As earlier pointed out (Nilsson-Cantell, 1921) I cannot agree with Hoek in uniting the Malayan forms under the two varieties (*sensu* Hoek) *communis* and *malayensis*. A study of his material in Amsterdam shows that there are many different forms included in those varieties. I think it is best to give an exact description of this subspecies to facilitate further identifications. The differences in the characters are indeed not very important but if they are summed up they are sufficient to institute a new subspecies.

Measurements of some specimens in mm.

		<i>carino-rostral diam.</i>	<i>height</i>
holotype	..	23.5	12
paratype	..	12	6
paratype	..	21.5	16

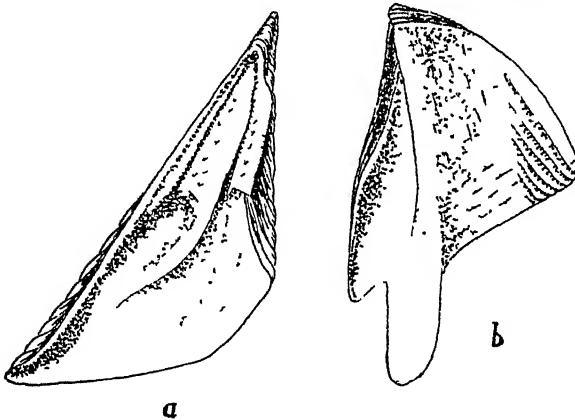
From this it appears that this subspecies can attain considerable size. Photographs are given to make it possible to identify them later. A smaller paratype was of interest as showing better than the larger specimens the original colour of the wall, which is smooth with violet longitudinal stripes on a lighter and somewhat red coloured ground. The stripes are not crossed by horizontal bands. In this the variety agrees with several subspecies of *B. amphitrite*. In the older specimens the colour and stripes are hardly seen, as the wall is rather corroded. The colour seems now to be grey. The shell is conical with a large rhombiform orifice generally toothed. The compartments are very strongly calcified and thick. The tubes are not much filled up, having in the upper parts transversal septa. Interior ribs of the parietes all continuous with septa in the wall.

The radii in the small specimen are well developed with the upper summit oblique. In the older specimens the radii are more corroded especially in the upper part. They thus seem to be rather narrow, which in reality is not the case.

The alae are of the typical shape and like other parts of the wall thick. The basis is thick and porous at least in the radial part.

The opercular valves are thick like the compartments.

The scutum has externally distinct growth-ridges not very strongly marked. Internally the scutum is very strongly sculptured, a characteristic feature for this species. The articular ridge is very strongly developed, about half the height of the valve, sometimes shorter. The adductor ridge is also very

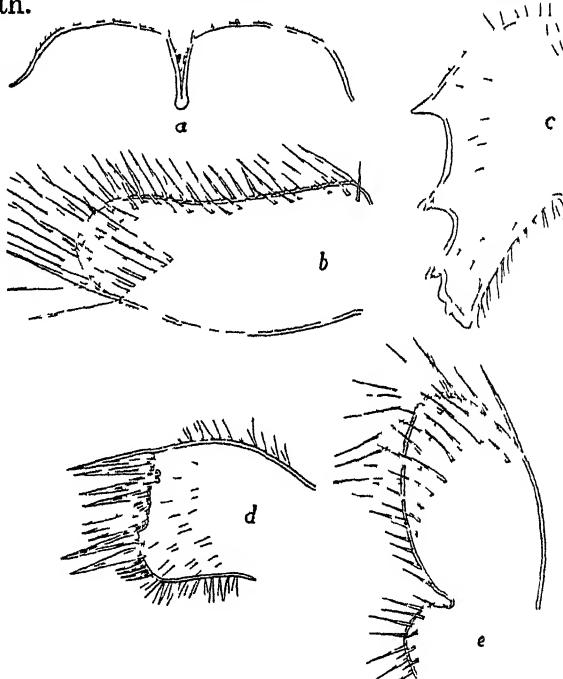


Text-fig. 5. *Balanus amphitrite rafflesii* n. subsp.
a. Right scutum. b. Right tergum.

strongly developed, extending up to the apex of the scutum. A small furrow is seen between the two ridges. The pit for the lateral depressor muscle is marked by a very small ridge, and is thus rather indistinct. Below the adductor ridge a shorter ridge is seen. This little ridge is traceable in several subspecies of *B. amphitrite*.

The tergum externally has growth-ridges and a slight longitudinal depression not folded in. The spur is well developed, sometimes a little shorter than is figured for the holotype. The extremity of the spur is rounded off, its width about a fourth of the basal margin of the tergum, a measurement given by Darwin for the species. This is however, as pointed out by Darwin, a variable character as measurements up to a third are found in some subspecies. The articular ridge is also here strongly developed. The articular furrow is deep as in the scutum. The crests for the depressor muscle are moderately developed. The tergum thus differs from what I earlier found in *B. a. communis*, to which these specimens come nearest.

Internal parts. Labrum with three teeth on each side of the notch. The teeth are not very strongly developed in the specimens dissected. On both sides of the notch there is moreover a small tooth.



Text-fig. 6. *Balanus amphitrite rafflesii* n. subsp.
a. Labrum. b. Palpus. c. Mandible. d. Maxilla I. e. Maxilla II.

The palpus is typical clubshaped with a distal longitudinal row of long spines externally. I do not consider the differences mentioned by Hoek (1913) between the var. *communis* and *malayensis*, the former with one row of distal spines the latter with a double row of such spines, of great systematic value. I have not in my studies of several subspecies of *B. amphitrite* found these differences between the palpi.

The mandible has three strong teeth and two smaller ones, the fifth confluent with the lower angle. Teeth 2 and 3 are double. The other mandible has the teeth less distinctly marked, a difference which is due to detrition. A study of specimens which have newly cast off the old chitinous cover, shows more distinct teeth, a feature which must be attended to in systematic studies on this group.

The maxilla I. has a rather straight edge, i.e. the lower part of the front edge is not very projecting but provided with stronger teeth. The notch below the upper spines is scarcely distinguishable.

The maxilla II. is of the shape typical for *Balanus amphitrite*.

If these specimens should be included under one of the varieties of Hoek it is not easy from the mouth-parts to decide under which. The palpus agrees according to Hoek with var. *communis*, the maxilla I. more with var. *malayensis*. Judging by external characters there are also similarities to both varieties of Hoek.

Number of segments of the cirri of the holotype:

I	II	III	IV	V	VI
14	32	16	16	17	18

32	16	17	18	32	29	..	35	..	36
----	----	----	----	----	----	----	----	----	----

The number of segments in this large holotype is a little higher than that stated by Hoek, for *B. amphitrite*, certainly depending on the fact that Hoek studied individuals of smaller size. The small recurved teeth on the front edge of the cirrus III. often found in *Balanus amphitrite*, as in other species, is also present here but the teeth are not so strong. The longer cirri have four pairs of spines on the front margin of the segments.

Locality: Pulau Sakra, near Singapore. Specimens on mangrove. May, 1933.

Subgenus *Chirona* Gray

Balanus amaryllis Darwin, 1854 forma *euamaryllis*, Broch, 1922.

New locality: 5° 59' 6" N. Lat., 99° 8' 33" E. Long. *Depth:* 73 m. Bottom temp. 25° C. Bottom: Dark grey mud. Large specimens adhering to a cable, with *B. ciliatus* situated on the wall. Collected from C. S. "The Cable". 9.2.33.

Distribution: Malay Archipelago, Indian Ocean, Japan, China, Northern coast of Australia.

Subgenus *Solidobalanus* Hoek, 1913.

Balanus ciliatus Hoek, 1913. Plate V, fig. 7, Text-fig. 7.

Balanus ciliatus Hoek, 1913, Nilsson-Cantell, 1925, Broch, 1931

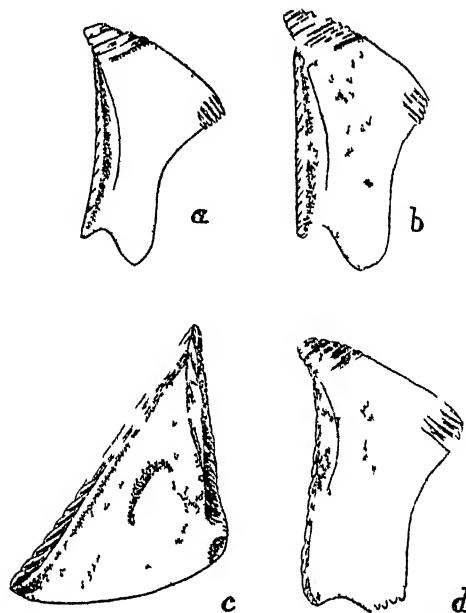
Supplementary description: This species is described by Hoek in the Siboga Expedition from individuals of a rather small size. Later on the species is dealt with by Nilsson-Cantell, 1925. The largest specimen of this collection from the Raffles Museum, Singapore measured 8.3 mm. in carino-rostral diam. Broch, 1931, described individuals with a diameter of 7 mm. The present collection contains individuals of different ages and seems to me to be the best made up to now. This species thus attains the ordinary size of *B. amphitrite*.

Measurements of some specimens in mm.:

<i>Carino-rostral length</i>			<i>Height</i>
6	..	..	3.5
12	..	..	13.
15	..	..	7.
13	..	..	9.

The colour of the specimens is nearly white. Sometimes as stated by Hoek light reddish, with the typical vertical narrow red stripes. The radii in these specimens are white, in Hoek's description "more or less distinctly orange-coloured." This may be a variable character as I (1925) found specimens with the radii white or coloured.

The structure of the compartments is as stated in the type description. Thus the parietes, radii and basis are without pores. The radii are broad with oblique summits. The internal surface of the thick compartments has strongly developed longitudinal ridges.



Text-fig 7 *Balanus, ciliatus* Hoek, 1913

a, b, d Right terga c Right scutum

The opercular valves. The scutum of these specimens agrees wholly with the description earlier given. Figures are given for comparison. In older specimens the pits for the adductor and lateral depressor muscles can be traced. The adductor ridge is rather indistinctly marked.

The tergum has a spur showing some variation due to age. In younger individuals it is rather pointed, in older ones more rounded with small tooth-like projections (Compare also Nilsson-Cantell, 1925). For further identifications some figures are given.

Internal parts. The mouth-parts agree in all particulars with the description given by Hoek, 1913 and Nilsson-Cantell, 1925. The same is also established as regards the cirri. Because these individuals are of larger size it is to be expected that the number of the segments especially in the longer cirri will be greater.

A comparison between specimens from this collection and Hoek's may be of interest.

	Size	I	II	III	IV	V	VI						
Raffles Museum Collection	Carino-rostr. length 11 mm. height 8.5 mm.	10	19	11	12	13	14	23	26	24	25	27	27
Siboga Collection	Smaller specimen	7-9	14	7	9	11	12	...	...	...	...	22	22
"	Larger specimen	8-9	14	10	11	11	13	16-	19-	19	20	24	...

It is of interest to note the presence of small recurved teeth on the front edge of the segments of the cirrus III. They are also established for cirrus IV. These teeth are not found in *B. auricoma*. Broch (1931 p. 72) says with regard to this character the following: "Nilsson-Cantell (1925) expresses his doubt as to the validity of the two species (*B. auricoma* and *ciliatus*) although he himself, after examination of *B. ciliatus*, emphasizes the existence of "nach unten gerichtete Zähne" in the longer ramus of the third cirrus, and says that "solche werden nicht bei *B. auricoma* angegeben. This evidently must be looked upon as a decisive specific character." I hold it not impossible that the two species are distinctly separated, but I do not think the absence of these teeth on the cirri is a character of great specific value. On studying several species of the genus *Balanus* one must note that these teeth on cirri III. and IV. are rather common in several species though very differently developed. Possibly the teeth may be better developed in older specimens. Perhaps also there exists a relation between the presence of these teeth in some individuals and an environment in which the orificium can easily be overgrown,—a feature of interest for investigators, who are able to study the species alive in their natural surroundings. In some specimens of this collection the wall is partly covered by sponges. In the very small specimens studied by me (1925) the teeth are very rarely developed.

New locality: 5° 59' 6" N. Lat., 99° 8' 33" E. Long. *Depth:* 73 m. *Bottom:* Dark gray mud. *Bottom temp.* 25° C. Several specimens adhering to a cable, some fixed on *B. amaryllis euamarillys*. On some specimens smaller *Octolasmis nierstraszi* were situated. Collected from C. S. "The Cable". 9-2-33.

INDO-MALAYAN CIRRIPEDS IN THE RAFFLES MUSEUM

Distribution: Malay Archipelago, Japan.

Subfamily TETRACLITINAE Nilsson-Cantell, 1921.

Genus *Tetraclita* Schumacher, 1817.

Tetraclita porosa viridis Darwin, 1854.

Syn. Nilsson-Cantell, 1921.

New localities: Raffles Lighthouse, Singapore. Coll. 1898.

Three specimens.

Butang Archipelago, Peninsular Siam. Two specimens on a Patellid.

Distribution: Difficult to state exactly. Known from West Indies (Broch, 1922), Japan, China, Malay Archipelago, Australia, West Africa ? (Pilsbry, 1916).

Subfamily CHELONIBIINAE Pilsbry, 1916.

Genus *Chelonibia* Leach, 1817.

Chelonibia patula (Ranzani, 1818).

New locality: Raffles Lighthouse, Singapore. Coll. 1898. Two specimens.

Distribution: Mediterranean, Atlantic, Malay Archipelago, Australia.

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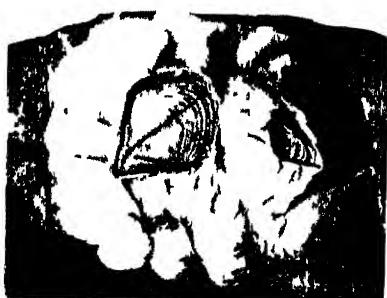
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INDO-MALAYAN CIRRIPEDS IN THE RAFFLES MUSEUM

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EXPLANATION OF PLATE V

Fig. 1. *Scalpellum stearnsi* var. *inermis* Annandale, 1905. Specimen, lateral view. Size 1/1.

Fig. 2. *Scalpellum persona* Annandale, 1916. Specimen, lateral view. Size 1/1.

Fig. 3. *Scalpellum sociabile* Annandale, 1905. Specimen, lateral view. Size 1/1.

Fig. 4. *Balanus amphitrite poecilosculpta* Broch, 1931. Specimens on a gorgonian stem. Size 1, 8/1.

Fig. 5. *Balanus amphitrite rafflesii* n. subsp. Specimens, lateral view. Size 2/1.

Fig. 6. *Balanus amphitrite rafflesii* n. subsp. Specimens, apical view. Size 2/1.

Fig. 7. *Balanus ciliatus* Hoek, 1913. Specimens, lateral view. Size 2, 2/1.

Note on a Starfish from Christmas Island, Indian Ocean

By W. K. FISHER

Neoferdina cumingii (Gray).

Ferdina cumingii Gray, Ann. Mag. Nat. Hist., 6, 1840, p. 283.

Neoferdina cumingii Livingstone, Australian Zoologist, 6, part 4, Feb. 1931, p. 307, pl. 21, figs. 1-3; pl. 23, figs. 1, 2.

The occurrence of this species at Christmas Island, Indian Ocean, apparently clears up the question of type-locality. The original description as well as the label carried by the types in the British Museum, give "West Coast of Colombia." The collector, H. CUMING, is known to have collected extensively in the Philippine Islands, as pointed out by H. L. CLARK¹. Since *Ferdina* has never been taken on the west coast of the Americas, Clark's doubt was certainly justified; and the present specimen confirms his belief that the home of the species is in the East Indies. Livingstone's excellent enlarged figures of the type leave no doubt in my mind that the Christmas Island specimen is really *cumingii*.

The greater radius is 19 mm.; the lesser 6.5 mm.; breadth of ray at base, 6.5 mm.

The Marine Mollusca of Christmas Island, Indian Ocean.

By J. R. LE B. TOMLIN

A collection of marine Mollusca, made by Mr. M. W. F. Tweedie, Assistant Curator of the Raffles Museum, in August and September 1932, was sent to me for identification. This collection, numbering rather over 100 species, combined with others made in the past, gives us, for the first time, an adequate idea of the marine Mollusca to be found on the Christmas Island littoral. Including some half dozen species from deep water the total now reaches about 170, with fairly equal relationships to the areas on either side. Owing to the Equatorial Current there are probably very few items on the Christmas Island list which do not occur on one or other of the Mascarene Islands. The connection with the Pacific side is particularly emphasized by the occurrence of several small gastropods which seem mainly characteristic of the Pacific area—say, roughly, from the Philippines to Hawaii on the east, and to the Paumotus in the south-east. Such are *Rissoina ambigua*, *R. triticea* and *R. turricula*, *Royella sinon*, *Cerithium zebrum* and *C. egenum*, *Triphora rubra* and *T. violacea*, and several *Engina*. There are not a few others which will eventually prove to belong to this group, when material from a number of localities is available.

1. Echinoderm Fauna of Torres Straits, Carnegie Inst., Washington, 1921, p. 59.

THE MARINE MOLLUSCA OF CHRISTMAS ISLAND

I have followed the systematic order of Thiele's *Handbuch*.
The letters *A* to *F* refer to the Bibliography.

CHITONIDAE

Onithochiton quercinus (Gld.) var. *scholvieni* Thiele.
Identified by J. S. Mackay. The typical form comes
from New South Wales.

HALIOTIDAE

Haliotis sp. juv. *D, E.*

FISSURELLIDAE

Diodora singaporensis (Reeve). *D, E.* Not taken by
Tweedie.

PATELLIDAE

Cellana profunda (Deshayes). Known from the Mascarene
Islands and the East African coast.

TROCHIDAE

Trochus (Cardinalia) virgatus Gmelin. Recorded from the
Red Sea to Japan.

T. (Rochia) niloticus L. *D, E.*

TURBINIDAE

Leptothyra filifera (Deshayes). Another Mascarene species.

Turbo petholatus L. A common oriental species.

T. (Senectus) lajonkairii Deshayes. *A, B, E.* Not a
common shell: taken also by Tweedie. Recorded from
Keeling Islands and from the "East Indies".

Astraea petrosa (Wood). A common Pacific species:
doubtful in the Indian Ocean.

NERITIDAE

Nerita albicilla L.

N. costata Gmelin. *B, E.*

N. plicata L. *A.*

N. polita L. *E.*

These four common Indo-Pacific species were all taken
alive by Tweedie.

N. maxima Gmelin. *A.* A not very common Pacific
species, taken also by Tweedie.

N. grossa L. *E.*

N. georgina Récluz. Described from King George Islands.
I have not seen any other locality mentioned.

N. pica Gould. Widely distributed in Japan and Polynesia.

NERITOPSIDAE

Neritopsis radula (L.). An Indo-Pacific species.

PHENACOLEPADIDAE

Phenacolepas elongata (A. Adams). I am doubtful whether this has ever been described, though examples are to be found so named in the British Museum. I have also one found by Miss McKinnon Wood at Mombasa.

LITTORINIDAE

Littorina undulata Gray. A. A very wide-spread Indo-Pacific species. Smith records it as *picta* Phil.

L. granocostata Reeve. A. Occurs throughout the Indian Ocean. Smith curiously enough described this as *granicostata* in A. p. 519 and altered it to *insularis* in P.Z.S. 1888 p. 536, on account of the priority of Reeve's name, but he never seems to have examined Reeve's types or to have discovered that *granocostata* and *granicostata* were identical species.

Tectarius malaccanus (Phil.). A. Both this and the last two taken alive by Tweedie.

RISSOIDAE

Amphithalamus (Anxietas) perplexus (Iredale). F. From 100 fathoms.

Zebina lis Tomlin. Found in shingle: described from Lifu and from Oshima.

Rissoina ambigua Gould.

R. triticea Pease.

R. turricula Pease.

All three are widely distributed in the Pacific, and sometimes extremely abundant in beach shingle.

ADEORBIDAE

Sansonnia sansonia Jousseaume. F.

S. kirkpatricki (Iredale). F.

S. (Reynellona) natalis (Iredale). F.

All three from 100 fathoms. I have followed Bavay as regards the names of the first two: his very careful account of the genera *Sansonnia* Jousseaume, *Mecoliotia* Hedley and *Pickworthia* Iredale will be found in Journ. de Conch. LXVI, pp. 155-161. Thiele omits *Sansonnia* from his *Handbuch* altogether and uses Hedley's name. The genotype of *Sansonnia* must of course be *Iphitus tuberculatus* Watson, as it is the only example of *Sansonnia* which Jousseaume cites by name. *Pickworthia* hardly seems wanted even as a section.

THE MARINE MOLLUSCA OF CHRISTMAS ISLAND

PLANAXIDAE

Planaxis niger Q. & G. A Pacific species.

P. longispira Smith. *D.* Found also by Tweedie. Under the name of *virgatus* Smith recorded in great profusion at Lifu (Journ. of Conch. VIII, 117). I have examined Smith's types of these two species and cannot find any distinction between them, except that they exhibit slightly different stages of wear and tear. Compare Smith's remark in *D.* p. 372.

POTAMIDIIDAE

Royella sinon (Bayle). For notes on this shell see Proc. Malac. Soc. X, 219.

CERITHIIDAE

Bittium glareosum (Gould).

B. hiloense Pilsbry and Vanatta.

These two Pacific species were found in shingle. The latter has been compared with topotypes from Hilo and is absolutely identical.

Cerithium echinatum Lamarck.

C. piperitum Sowerby.

C. nesioticum Pilsbry.

C. egenum Gould.

These are all four Pacific species with a wide range.

C. citrinum Sowerby. Mainly a Philippine species.

C. zebrum Kiener. *D, E.* A widespread and abundant Pacific shell with many named colour varieties. Tweedie found it in shingle.

Plesiotrochus fischeri Smith. *D, E.* This rare form was also found by Tweedie. Only known from Christmas Island.

CERITHIOPSIDAE

Cerithiopsis catenaria Melvill and Standen. One small shell I refer rather doubtfully to this species, only known so far from Lifu.

TRIPHORIDAE

Triphora rubra (Hinds).

T. violacea (Q. & G.).

Both found in shingle: widely distributed in the Pacific.

T. triticea Pease. *D, E.* Figured by Smith. The type, which is in the British Museum, came from Hawaii.

MELANELLIIDAE

Balcis vitrea (A. Adams). A Pacific species.

SHERBORNIIIDAE

Sherbornia mirabilis Iredale. *F.* From 100 fathoms.

AMALTHEIIDAE

Cheilea diaphana (Roeve). *D, E.* Probably a synonym of *C. equestris* (L.).

Amalthea australis (Deshayes). *D, E.* A common Pacific species.

STROMBIDAE

Strombus lentiginosus L. Common in the Indo-Pacific.

NATICIDAE

Natica areolata Récluz. Also an Indo-Pacific species.

CYPRAEIDAE

Pustularia childreni (Gray). An interesting and rather uncommon Cowry.

P. cicercula (L.). Common and very widely spread in the Indo-Pacific.

Cypraea helvola L.

C. mauritiana L. *E.*

C. vitellus L. *B, E.*

C. lynx L. *B, E.*

C. poraria L. *D, E.*

C. histrio Dillwyn. *B.*

C. arabica L. *B, E.;* var. *gillei* Jousseaume. *E.*

C. caput-serpentis L.

C. moneta L. *B, E.*

C. annulus L. *B, E.*

C. minoridens Melvill.

These are all more or less common Cowries of very wide range in the Indo-Pacific.

CASSIDIDAE

Phalium vibex (L.). Also Indo-Pacific.

CYMATIIDAE

Cymatium chlorostoma (Lam.). *A.* Ranges from the Cape Verde Isles round S. Africa to the Red Sea, and over most of the Indo-Pacific.

Colubraria ceylonensis (Sow.).

BURSIDAE

Bursa tuberculata (Brod.).

Both this and the last are Indo-Pacific species.

B. cruentata (Sow.). *A.* Recorded from Mauritius to the Philippines.

MURICIDAE

Murex (*Chicoreus*) *microphyllus* Lam. An Indian Ocean shell.

M. (Naquetia) triqueter Born. Known from the Red Sea eastwards to the Paumotus.

THE MARINE MOLLUSCA OF CHRISTMAS ISLAND

Drupa rutilus (L.). *A, B.*

D. rubus-idaeus Röding. *E.*

D. morum Röding. *E.*

D. uva Röding. *B, D, E.*

All four are well known Pacific forms.

D. andrewsi Smith. *D, E.* Peculiar to Christmas Island.

All these species of *Drupa* were taken living by Tweedie.

D. martensi Dall? Two small, worn and somewhat doubtful specimens. It occurs not uncommonly in shingle from the Philippines but I have never seen it fresh.

Maculotriton bracteatus (Hinds).

M. digitalis (Reeve). These two have a very wide range throughout the Indo-Pacific.

Nassa sertum (Bruguière). *B.* Taken also by Tweedie. Ranges from the Red Sea to the Paumotus.

Thais armigera (Lam.). *E.* Taken alive by Tweedie. Pretty common in the Philippines.

T. pseudohippocastanum Dautz. For the change of name (from the more familiar *hippocastanum*) see Faune des Colonies Françaises vol. III, p. 427, 1929. The species occurs generally throughout the Indo-Pacific.

MAGILIDAE

Coralliophila violacea (Kiener). *D, E.* Taken also by Tweedie. An Indo-Pacific species.

PYRENIDAE

Pyrene obtusa (Sow.). A Pacific species, ranging eastwards from the Philippines.

P. cumingii (Reeve). Recorded hitherto from Mauritius and the Philippines.

P. varians (Sowerby). *D, E.* Smith records a variety of this: not found by Tweedie.

Seminella nanisca (Hervier).

S. hervieri (Pace)?

Both so far only known from Lifu. I have recently detected *nanisca* in shingle from Cabra Island.

BUCCINIDAE

Engina nodicostata Pease. Recorded only from Fiji and one or two other Pacific groups.

E. lineata (Reeve).

E. melanozona Tomlin.

Both common in the Philippines and eastwards.

E. purpureocincta Preston. Living specimens: described from Ceylon.

E. mendicaria (L.). *A, B, E.* Taken living by Tweedie. Thiele in his *Handbuch* considers *Pusiosioma*, which was erected for this species by Swainson, a mere synonym of *Engina*.

Pisania crenilabrum A. Adams. Taken living.

Caducifer sculptilis (Reeve).

C. eximius (Reeve). Neither very common but known from the Mascarenes to Polynesia.

Pollia undosa (L.). *B, D, E.* Taken living by Tweedie. An Indo-Pacific species.

P. marmorata (Reeve).

P. gracilis (Reeve). Both Pacific forms.

NASSARIIDAE

Nassarius papillosus (L.). *D, E.* Philippines and Polynesia.

N. concinnus (Powis). Common in Mauritius, the Philippines and Lifu.

N. pauper (Gould). A Pacific species, difficult to identify satisfactorily, but certainly very widely distributed.

N. marratii (Smith). *E.* Taken also by Tweedie. Smith's unique *Nassa exulata* is a rather worn and bleached *marratii*, which was described from the Solomon Is.

FASCIOLARIIDAE

Latirus nodatus (Gmelin). *E.* Taken also by Tweedie. A Pacific species.

L. turritus (Gmelin). Mascarene Is. to Polynesia.

Peristernia venusta Smith. *E.* Of this new species one only was dredged in Flying Fish Cove in 45 fathoms.

P. nassatula (Lam.). *D, E.* Taken alive by Tweedie. Red Sea, Mascarenes and Seychelles to the Paumotus.

Leucozonia smaragdula (L.). *B, E.* Taken by Tweedie. Mauritius and Madagascar to the Pacific.

OLIVIDAE

Oliva paxillus Reeve. Known from the Philippines, Japan and some of the Pacific islands.

MITRIDAE

Mitra (Strigatella) litterata Lam. *B, E.*

M. (S.) paupercula (L.). *B, E.*

M. (S.) retusa Lam. *D, E.*

These three were all taken living by Tweedie.

THE MARINE MOLLUSCA OF CHRISTMAS ISLAND

M. (S.) virgata Reeve. *A.* What this *Mitra* was it is hard to say. Reeve's *virgata*, in the Conch. Icon. Monograph, Vol. II, pl. 25, f. 197a, b was a composite species—f. 197a being in all probability *retusa* Lam. and 197b *paupercula* L. Moreover, in any case, the name *virgata* is preoccupied by Gmelin's *Voluta virgata*, which is also a *Mitra*. In *B.* p. 117 Smith speaks of "a short form like *virgata* Reeve (f. 197b) with spire transversely grooved and the white stripes on body whorl somewhat raised forming feeble costulations". This he calls *paupercula* var., but he makes no reference to the shell recorded as *virgata* in 1887. It would be best to omit *virgata* from the list.

M. (Chrysame) fulva Swainson. *E.*

M. (C.) tiarella A. Adams.

Both fairly common species from Mauritius to the Pacific.

M. (C.) turgida Reeve. Not very common in the Philippines and Polynesia.

M. (Callithea) aureolata Reeve. Ranges from Mauritius to the Pacific.

M. (Pusia) nodosa Reeve. Mauritius to the Philippines.

M. (Dibaphus) edentula Swainson. Mauritius to the Pacific.

M. (Thala) brevicula Souverbie. Known only from New Caledonia.

VASIDAE

Vasum ceramicum (L.). A common Pacific species.

MARGINELLIDAE

Marginella hirasei Bavay. Described from Japan: I have recently found it fairly common in shingle from Cabra Island.

CONIDAE

Drillia pulchella (Reeve).

D. bijubata (Reeve).

D. pica (Reeve).

Cythara gracilis (Reeve). These four Turrids are all known from Mauritius and from the Pacific.

Anarithma metula (Hinds). For a long note on the history and range of this shell see Proc. Malac. Soc. London, Vol. X, p. 27.

Pseudoraphitoma nexa (Reeve).

P. lutea (Pease).

P. papillosa (Garrett).

All three are known chiefly from the New Caledonia area.

Conus ebraeus L. *B, D, E.* var. **vermiculatus** Lam. *D, E*

C. coronatus Gmelin. *B, E.*

C. miles L.

C. catus Brug.

C. rattus Brug.

These Cones are all generally distributed species of the Indo-Pacific.

TEREBRIDAE

Terebra crenulata (L.) *B.*

T. undulata Gray. *E.*

Two fairly common Indo-Pacific species, not found by Tweedie.

T. interlineata Deshayes. Sometimes considered a Pacific variety of *crenulata* L.

ATYIDAE

Smaragdinella viridis (Rang). *B, D, E.*

CORAMBIDAE

Doris coriacea Abraham. *B.*

PHYLLOPSIDAE

Phyllidia varicosa (Lam.). *B.*

ONCIDIIDAE

Peronia peronii Fleming. *B.*

SIPHONARIIDAE

Siphonaria ferruginea Reeve. *D, E.*

Described from an unknown locality.

ARCIDAE

Barbatia decussata (Sowerby). *E.*

Has a very wide range in the Indo-Pacific.

B. maculata (Sowerby). *D, E.*

Probably Smith's *Arca imbricata* in his 1900 list is the same thing. In those of 1909 and 1911 he only records *maculata*, and probably changed his mind as to the identification of the species. There is much doubt as to whether the name *imbricata* Brug. should be applied to an oriental or an occidental form.

MYTILIDAE

Septifer bilocularis (L.). *B, D, E.*

Very common in the Indo-Pacific. I am quite unable to separate *S. excisus* (Wiegmann) from *bilocularis*.

THE MARINE MOLLUSCA OF CHRISTMAS ISLAND

Lithophaga lithura Pilsbry.

So far only known from Japan.

Brachidontes rufolineatus Smith.

Described from Christmas Island, not found by Tweedie.

VULSELLIDAE

Isognomon perna (L.).

Probably occurs throughout the Indo-Pacific. Baird described it as new under the name *samoënsis* from the cruise of the "Curacao."

I. legumen (Gmelin).

I. dentifera (Krauss).

Both Indian Ocean species whose range is imperfectly known.

Pinctada vulgaris (Schumacher).

This species is very fully discussed by Jameson in Proc. Zool. Soc. London, 1901, p. 384.

PECTINIDAE

Chlamys weberi Bavay.

A Japanese species.

Spondylus hystrix Röding.

S. pesasinum Röding.

Both known from Mauritius to the Philippines.

OSTREIDAE

Ostrea cucullata Born.

Universally distributed in the Indian Ocean.

CARDITIDAE

Mytilicardia variegata (Brug.).

A common Indo-Pacific species.

TRAPEZIIDAE

Trapezium oblongum (L.). *D, E.*

Tweedie only took the next species; both are widely distributed in the Indian Ocean, and very probably in the Pacific as well.

T. angulatum (Lam.).

LUCINIDAE

Codakia divergens (Phil.).

Range probably Indo-Pacific.

CHAMIDAE

Chama brassica Reeve.

A common Indian Ocean shell.

CARDIIDAE

Cardium (Trachycardium) philippinense Deshayes.

Only known from the Philippines.

C. (Fragum) rubescens Smith. *E.*

Only known from Christmas Island; dredged in 30 fathoms.

TRIDACNIDAE

Tridacna gigas (L.). *B, E.*

Very young specimens. Tweedie only found the next species.

T. compressa Reeve.

This may be Smith's *Tridacna* sp. of the 1909 list.

VENERIDAE

Antigona reticulata (L.).

SEMELIDAE

Semele sp.

TELLINIDAE

Tellina (Arcopagia) scobinata L. *E.*

Taken also by Tweedie. Known from Mauritius to the Philippines.

PHOLADIDAE

Xylotrya, two spp. *D, E.*

TEREDINIDAE

Teredo sp. *D, E.*

OMMASTREPHIDAE

Ommastrephes sp. *B.*

OCTOPODIDAE

Octopus rugosus Bosc. *D, E.*

Recorded by Smith as *Polypus granulatus* Lam.

Possibly the *Octopus* sp. of the 1900 list was also this.

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A New Goby from Singapore Island.

By A. W. C. T. HERRE

Gobiella birtwistlei new species.

Dorsal V—I—8 or 9; anal I—10—11 or 12; there are apparently 28 or 30 scales in a longitudinal series.

The upper part of the anterior half of the body is slightly compressed, with protuberant abdomen, the posterior portion of the trunk strongly compressed; the depth is 4.3 to 3.8 times, the head 3.6 to 4 times, the caudal 4 to 5.1 times in the length; the eye equals the interorbital, 4 to 4.33 times in the head; the snout is much shorter than the eye, 4 to 6 times in the head; the pectoral equals the caudal; the ventrals are 1.6 times in the head; the least depth of the caudal peduncle is 2.2 to 2.6 times in its length; the second spine of the first dorsal is longest, 2.6 to 3 times in the head; the second and third spines of the second dorsal and anal are longest, 1.85 to 2 times in the head.

The mouth is strongly oblique, the maxillary extending beneath the front part of the eye or the anterior margin of the pupil; the backward curved teeth are in a single closely set row; the tongue is deeply emarginate, almost lunate; the scales are invisible in life and are only made out with difficulty in preserved specimens, those on the abdomen and at the second dorsal and anal bases most evident; the ventrals are beneath or behind the pectoral base; the second dorsal and anal are opposite each other; the caudal is truncate.

This little goby is transparent to translucent in life, the eggs of gravid females plainly visible through the abdominal wall. Living specimens are usually visible only when they move.

In alcohol or formalin specimens turn white and opaque at once and the fins become visible. Black specks form a more or less evident band near the base of the second dorsal and of the anal, continuing as a stripe or row to the caudal base; often there is a band of black dots from below the pectoral base along the abdomen to the anal; there are a few black specks on the nape and often the under side of the head is dotted, with a black median line on the anterior part of the abdomen.

This tiny goby is abundant in brackish water tidal creeks on the island of Singapore. Mature specimens are from 15.5 to 25 mm. in length, with no appreciable difference in the length of the sexes. Females seem to be more numerous than males. 140 specimens collected March 13th to 18th 1934, are from 14 to 25 mm. in length. The types are in the Zoological Museum of Leland Stanford Junior University, California, and co-types are in the Raffles Museum at Singapore.

This tiny goby is near *Gobiella pellucida* Smith, from Bangkok, Siam, but differs in the second dorsal and anal fins, in scalation, teeth, and other details. Apparently the Siam fish is found in fresh water only, the Singapore species in brackish water, but this may be merely because we know so little about these fishes.

The Singapore species has undoubtedly been overlooked in the past because of its invisibility in the water and its small size, even though it is abundant where it occurs. Specimens captured have either not been picked up or else have been discarded as very young fry of larger fish.

I take pleasure in naming this species after Mr. W. Birtwistle, Officer-in-charge, Fisheries Department, S. S. & F. M. S.

Notes on *Echinosorex gymnurus* (Raffles)

By F. N. CHASEN

Twenty-four well made skins¹ illustrate variation in this species along the north-west coast of Borneo from Kuching in Sarawak to Sandakan in British North Borneo.

The material confirms a previous view² that animals from the extreme north of Borneo are whiter (less sprinkled with black hairs) than those from most of Sarawak. It also shows that in the extreme west of Sarawak parti-coloured black and white examples very like typical *E. g. gymnurus* of Sumatra occur.

I cannot trace a record of an albescens *Echinosorex* from the Malay Peninsula³ but a few are known from Sumatra. On the other hand the greater part of Borneo seems to be occupied by almost entirely white animals: they are, at least, dominant everywhere with the possible exception of the north-west corner of the island in which nothing is known of *Echinosorex*. A progressive tendency to albinism along the north coast, roughly from west to east, makes it necessary to recognize more than one Bornean race.

1. Not a large series but probably the greatest number of specimens ever examined from such a limited locality.

2. Chasen and Kloss, Bull. Raffles Mus., 6, 1931, p. 45.

3. In Blanford's reference to entirely white specimens "Burmese" must be a misprint for "Bornean".

NOTES ON ECHINOSOREX GYM NURUS (RAFFLES)

E. g. albus (Giebel).

Gymnura alba Giebel, Zeitschrift für die Gesammten Naturwissenschaften 22, 1863, p. 277; pls. 1 and 2 (Borneo).

Specimens from near Sandakan in the extreme north of Borneo have been described in detail elsewhere: broadly speaking, they are entirely white on the underparts but show a few black-tipped hairs on the dorsal surface, although the position and number of these is variable. From Lyon's description¹ of specimens from south-west Borneo, and by analogy, animals recorded by various authors from north, south, south-west, west, and central Borneo probably belong to this race the type locality of which can be restricted to the likely locality of Bandjermasin in south Borneo. Giebel's description and plate indicate a very white animal.

E. g. candidus (Günth.)

Gymnura rafflesii var. *candida* Gunther, Proc. Zool. Soc., 1876, p. 425 (Labuan).

Seven of the twenty-four Bornean skins are from near Sandakan and are referred to *albus* above. Of the remaining seventeen skins, only two examples, from Kuching and Baram, could be confused with the north Bornean series and these not with the whitest examples therein. The others are pied, like the Sumatran and Continental races, or white plentifully sprinkled with long, black hairs on the upper parts: animals of the latter type are dominant in the neighbourhood of Kuching and also occur at Balingian (about halfway along the Sarawak coast) and as far north as the island of Labuan and the opposite mainland.

The three skins of "normal" colour deserve closer attention for hitherto such specimens from Borneo seem only to have received two casual references in literature². One specimen is without definite locality but that it came from Sarawak is certain and from the western part of the State more than likely: the other two are labelled in some detail as from Kuching in 1894 and 1896.

The type locality of *Viverra gymnura* Raffles is Bencoolen on the south-west coast of Sumatra. Unfortunately, only two specimens³ from that island are available for comparison: both are from the north-east coast (near Medan and Pematang Siantar) and it is just possible that they should be referred to the northern race (*burmanicus* Trouess., syn. *minor* Lyon) of

1. Lyon, Proc. U. S. Nat. Mus., xxxvi., 1909, p. 453.

2. Dobson, Mon. Insectiv., 1882, p. 4; Shelford, A Naturalist in Borneo, 1916, p. 27 (an indirect reference).

3. Kindly lent by Dr. K. W. Dammerman and Mr. H. J. V. Soddy.

the species which is said to differ in colour-pattern from typical *gymnura*.

From these two Sumatran skins the Bornean specimens differ in having the pale areas of the head, neck and fore-back more solidly white. Except on the forehead, sides of the head, and chin the Sumatran examples have the pale areas formed by numerous, scattered, long white hairs growing out of a shorter, soft, dark grey under-fur whereas in those from Borneo the under-fur of the head and neck is largely white and tipped with white even on the back. Although normal in pattern, these animals in fact show the tendency to albinism so marked a feature of the species in Borneo.

Whether or not they differ in colour from exact topotypes of *E. g. gymnurus* cannot now be decided. The largest skull has the basal-length 79.95 mm. which is within the range of both *E. g. gymnurus* and *E. g. candidus*: but as both parti-coloured and white specimens occur near Kuching it is preferable to place all with the variable Sarawak form and to regard *candidus* as a variable race, darker than *albus* and extending from Kuching to Labuan. At the same time the possibility that the range of typical *gymnurus* extends to extreme north-west Borneo whence no information is available must not be forgotten.

The two races, *candidus* and *albus* seem to meet in the vicinity of Labuan where "white" animals representing both forms are found. It therefore seems permissible, and it is certainly convenient, to regard Günther's *candidus* as representing the darker form although this author's description would fit selected examples of either race.

Note.—Adequate series of *Echinosorex* from places outside Borneo seem not to exist in any museum. The following is a grouping of the published measurements¹ of the basal length of adult skulls (on the available figures and specimens no sexual difference in size can be made out) together with those of a few unrecorded specimens in the Raffles Museum, arranged geographically, roughly from north to south.—

Sumatra

<i>North</i> .—Medan; Siantar; Tapanuli,	70	73	mm.
<i>Central</i> .—Siak and Mandau Rivers;			
Pulau Tebing Tinggi, ..	73	78	mm.
<i>South</i> .—Bencoolen (topotypes) ..	70	77	mm.

¹. Detailed measurements have been published by Lyon (l.c.s.); Robinson and Kloss, Journ. F. M. S. Mus., vii, 1919, p. 268; and Chasen and Kloss (l.c.s.).

NOTEWORTHY RECORDS OF BIRDS FROM PERAK

Malay Peninsula

North.—Peninsular Siam, ..	67 ¹ -75	mm.
Central.—Perak; north Pahang; Selan- gor, ..	70.5-74.5	mm.
South.—South-east Pahang; south Johore, ..	78.5-82.6	mm.

The above ranges are based on very scanty material. They do, however, suggest that while no dimensional subspecies can yet be recognized in Sumatra there remains just a possibility that the species may run small in the north of the island as is certainly the case in the Malay Peninsula.

Animals from Peninsular Siam with a range for the basal length of the skull of 67-75 mm. against 70-77 mm. in topotypes of *gymnurus* cannot be separated on size alone but two specimens from the south of the Malay Peninsula are conspicuously large.

There is some diversity of opinion² about the colour differences between *birmanicus* and *gymnurus*. The two skins from north-east Sumatra mentioned above can be matched, approximately, by two skins from Tenasserim and Selangor but the north Sumatran race may be *birmanicus* as hinted above.

The two Bornean races are alike in size and indubitably larger than *E. g. gymnurus*. The basal length of the skull ranges from 76.6 to 85.5 mm.

It may be noted that vertebrate species showing an increase in size from north to south are very rare.

Noteworthy Records of Birds from Perak

By F. N. CHASEN

During the past few years I have often identified, or confirmed the identification, of bird-skins sent to the Raffles Museum by Mr. A. T. Edgar who has been active in investigating the avifauna of Sitiawan in Lower Perak, and the adjacent parts of the territory known as the Dindings on the west coast of the Malay Peninsula. Some of the specimens examined seem to merit published notice and, if in some cases the addition to our knowledge seems insignificant, it can be remembered that the distribution of birds in the Malay States is now, generally, so well known that extensions of range within the area are especially interesting.

¹ The minimum basal length of full-grown skulls is probably rather more than 67 mm. The smallest skull is the series recorded by Lyon is said to have the teeth only slightly worn and the basioccipito-sphenoid suture distinctly open.

² c.f. Lyon *I.c.s.*, p. 453 and Kloss, *Journ. Nat. Hist. Soc.*, ii, 1917, p. 298.

Sphenocercus seimundi seimundi Rob.

Two females of this rare pigeon, which has recently been recorded from Bangkok (Journ. Siam Soc., Nat. Hist. Suppl., viii, 1932, p. 341) were obtained at Tanjong Katak in the Dindings in August 1933.

(a) "Bill, blue, apical one-third greyish horn; irides, inner ring blue, outer ring fawn; orbital skin, blue; feet, crimson, soles, yellow, claws, brown" (A. T. E.).

(b) "Outer ring of iris, pink" (A. T. E.).

Wings, 147, 152 mm.

Enopopelia tranquebarica humilis (Temm.).

Although this species has been recorded from "Malacca", records from so far south in the Malay Peninsula almost certainly refer to specimens originally imported as cage-birds. The species certainly occurs in a naturally wild state as far south as the Isthmus of Kra, but it seems that its status in the Malay States must still be a matter for consideration as a nest with eggs was found at Sitiawan, Lower Perak, in March 1933, the skin of one parent being sent to Singapore for identification.

Crocethia alba (Pall.).

A specimen in winter plumage, collected on 19th December 1933 in the Dindings, adds the species to the avifauna of the Malay Peninsula. Although it is said to be common, in season, along the China coast, the Sanderling is apparently rare along the coasts of Burma and French Indo-China and unrecorded from Siam. There are bare records from Borneo, Java and Christmas Island in the Indian Ocean.

Dissoura stormi (Blas.).

A head of this rare stork of which few specimens are known was sent from Sitiawan in Lower Perak. The species was originally described from Borneo and has since been collected on the east coast of Sumatra: the present is the first continental, and most northerly record.

The culmen, which is strongly recurved and with a marked basal boss, measures 168 mm. in length: the bill appears to have been orange-red in colour.

Peters ("Check List of Birds of World", i, 1931, p. 128) regards this form as the Bornean subspecies of *D. episcopus* and although several authors have emphasized that it is a distinct species, re-examination of "*episcopus*" from Borneo and Sumatra may prove that *stormi* is, after all, only a geographical race of *episcopus*. In the Malay Peninsula *D. e. neglecta* is only known from the north. All the *Dissoura* I have seen from Borneo

NOTEWORTHY RECORDS OF BIRDS FROM PERAK

(including the British Museum series) are *stormi* and it is doubtful if any other form occurs on the island.

Accipiter badius poliopsis (Hume).

The remains of an adult female of this hawk were forwarded from Sitiawan where the bird was picked up, injured, in December 1932. The species is common in Siam but very rare in the non-Siamese portion of the Peninsula.

Rhopodytes tristis longicaudatus (Blyth).

A female was collected at Sungai Batu in the Dindings. Its occurrence in the lowlands so far south in the Malay Peninsula, is interesting as in the southern parts of its range this race has hitherto only been recorded from high elevations in the mountains.

Picus vittatus vittatus Vieill.

The curious gap in the distribution of this species (*vide* Kloss, Ibis, 1926, p. 688) has been slightly shortened by the discovery of this race at Sitiawan in Lower Perak. Previously, the race was only known from as far north as Kuala Selangor on the coast of Selangor.

Chotorhea chrysopogon laetus Rob. & Kloss.

The altitudinal range of this barbet is unusually large for it is found in the lowlands of Perak, the Dindings, Selangor and Malacca, more commonly in submontane districts throughout the Peninsula, and up to 5,000 feet on Gunong Kerbau in Perak.

An interesting point brought out by a recently acquired specimen from the Dindings is that although the differences between the Malayan *laetus* and typical *chrysopogon* of Sumatra are very well marked when birds from the Malayan mountains are compared, the distinction is usually less obvious in the case of birds from the Malayan lowlands.

Xantholæma hæmatocephala indica (Lath.).

This barbet, common in Peninsular Siam, does not occur in the south of the Malay Peninsula. Specimens in the Raffles Museum from the Nerus River in the north of Trengganu, and from Lenggong and Kuala Kangsar in Perak, were hitherto the most southerly known examples and breeding birds at Sitiawan, Lower Perak, therefore represent a slight but interesting extension of the range southwards.

Dicrurus longicaudatus intermedius Blyth.

Specimens from the Dindings and Sitiawan mark a notable extension of range as the species was only known as far south as Kedah and Penang.

Nine New Races of Natuna Birds

By F. N. CHASEN

The following diagnoses are based on birds collected by myself in the northern islands of the Natuna group in the South China Sea in 1928, and by Mr. P. M. de Fontaine, of the Raffles Museum, in the southern islands, in 1931. A detailed account of the collections will appear at a later date. Dr. H. C. Oberholser¹ has recently published an account of the Natuna avifauna including the descriptions of a number of new forms. Some of the undermentioned species were not represented in the collection he reported on: in other cases the material appears to have been inadequate for description.

Treron fulvicollis oberholseri subsp. nov.

Osmotreron fulvicollis, Hart., Nov. Zool., 1, 1894, p. 482 (Bunguran).
Dendrophassa fulvicollis, Oberh., Bull. U. S. Nat. Mus., 159, 1932, p. 30 (Bunguran).

Like *T. f. fulvicollis* of Sumatra² and the Malay Peninsula but larger.

Type.—Adult male, collected on Bunguran Island, North Natuna Islands, on 11th September 1928 by F. N. Chasen.

Total length, 266 mm.; tail, 86 mm.; wing, 153 mm.; tarsus, 20 mm.; bill from gape, 21 mm.

Iris, red; lids, orange and yellow; bill, pale greenish grey; cere and base of lower mandible, red; feet, red.

Specimens examined.—Three males and two females from Bunguran.

Wings.—♂, 153 (type); 152, 155; ♀, 151, 155 mm.

Remarks.—The difference in size between the Bunguran race and the typical form is not great but is sufficient to indicate a slightly modified, insular subspecies as in the case of *Treron vernans*. Males from the Malay Peninsula have a wing-range of 142–151 mm. (the latter figure is not common); Tenasserim, 138–147 mm.; Borneo (not including *T. f. baramensis*) 141–144 mm.; Sumatra, 138–141 mm.; Bintang Island, Rhio Archipelago, 141–152 mm.; Billiton, 151 mm. The three Natuna males are very green on the abdomen, but one from the coast of Selangor is similar.

1. "The Birds of the Natuna Islands", Bull. U. S. Nat. Mus., 159, 1932, pp. 1–157.

2. "Sumatra", restr. type loc., Rob. and Kl., Journ. Nat. Hist. Soc., Siam, V, 1921, p. 30.

NINE NEW RACES OF NATUNA BIRDS

Spilornis cheela natunensis subsp. nov.

Spilornis pallidus, Hart., Nov. Zool., I, 1894, p. 482 (Bunguran).

Spilornis pallidus subsp., Hart., Nov. Zool., II, 1895, p. 476 (Bunguran).

Spilornis cheela salvadorii, Swann, Syn. List Acc., 2nd ed., 1922, p. 135 (Bunguran).

Spilornis cheela pallidus, Oberh., Bull. U. S. Nat. Mus., 159, 1932, p. 18 (Bunguran).

Like *S. c. pallidus* of Sarawak, but smaller and in fresh plumage darker on the mantle and under parts: breast, greyer and less brown. The dark bars on the thighs and under tail coverts conspicuously darker: pale band on the tail narrower.

Type.—Adult female, collected on Bunguran Island, North Natuna Islands, on 1st September 1928, by F. N. Chasen.

Total length, 478 mm.; tail, 220 mm.; wing, 324 mm.; tarsus, 73 mm.; bill from gape, 38 mm.

Iris, and bare skin on head, yellow; bill, bluish grey; feet, yellow.

Specimens examined.—Two females and one unsexed bird, probably a male.

Wings.—♀, 324 (type); 313; ? ♂, 307; tails, ♀, 220, 213; ? ♂, 200 mm.

Remarks.—I have not seen *salvadorii* of Nias Island, West Sumatra: it was originally said to be like *pallidus*¹, but smaller but Swann (l.c.s.), adds that it is "much paler (especially on wing coverts)." It is impossible that birds from Nias and Bunguran can belong to the same race. Natuna birds have a wing-range of 295–324 mm.², and *fide* Swann, Nias birds are about the same: Berlepsch gives 290–304 mm. for *salvadorii*.³

Males of *pallidus* have the wing down to 321 and 325 mm. in length which makes them about the same size as females of *natunensis*: females of *pallidus* run up to 350 mm. in wing-length. The immature bird from the Anamba Islands, recorded as *Spilornis cheela* subsp.³ does not belong to this form and is best placed with the Malayan subspecies.

Psittacula longicauda defontainei subsp. nov.

Palaeornis longicauda, Hart., Nov. Zool., I, 1894, p. 481 (Bunguran and Sirhassen); II, 1895, p. 474 (Bunguran and Pulau Laut).

Psittacula longicauda, Oberh., Bull. U. S. Nat. Mus., 159, 1932, p. 35. Bunguran, Sirhassen, Subi).

1. Berlepsch, Nov. Zool., II, 1895, p. 73.

2. c.f. Hartert, l.c.s.

3. Journ. Mal. Br. Roy. Asiat. Soc., VI, pt. 3, 1928, p. 54.

Like *P. longicauda* of the Malay Peninsula but larger: red on the head often slightly deeper in colour in both sexes.

Type.—Adult male, collected on Bunguran Island, North Natuna Islands, on 29th August 1928, by F. N. Chasen.

Total length, 376 mm.; tail, 226 mm.; wing, 160 mm.; tarsus, 15 mm.; bill from gape, 19 mm.

"Iris, double; inner ring, greenish brown; outer ring, yellowish white; upper mandible, rose-pink; lower mandible brown; feet greenish grey.

Specimens examined.—Seventeen, from the islands of Bunguran, Sirhassen and Subi.

Wings.—Bunguran, ♂, 160 (type); 164, 156 (imm.); ♀, 152, 149, 146 (imm.); Sirhassen and Subi, ♂, 157, 164, 164, 168, 160, 158, 165; ♀, 154, 156, 156 mm.

Remarks.—Topotypical males of *P. l. longicauda* have the wing measuring 150, 152, 152, 152, 150, 150, 147, 144, 143=143-152 mm. against 157-168 mm. in Natuna birds. The wings of female *longicauda* measure 141, 135, 145, 139, 147, 149=135-149 mm. against 149-156 mm. in *defontainei*. A few birds from Sumatra and some from Borneo all fall within the wing-ranges given for *longicauda* above. Unsexed birds cannot be used for comparison as some young males, in the plumage of the female, have rather longer wings than females.

Birds from Bintang Island in the Rhio Archipelago, with wings measuring 154-165 mm. in males and 152-156 mm. in females, are best placed with the new race although they average paler on the pink areas of the head than true *defontainei*.

Zanclostomus javanicus natunensis subsp. nov.

Zanclostomus javanicus, Hart., Nov. Zool., I, 1894, p. 481 (Bunguran); II, 1895, p. 475 (Bunguran); Oberh., Bull. U. S. Nat. Mus., 159, 1932, p. 34 (Bunguran).

Like *Z. j. pallidus* of the Malay Peninsula but the grey of the under parts so strongly washed with rufous-buff that the line of demarcation between the colour-zones on the under parts is obliterated: lores more extensively rufous as in typical *javanicus* of Java.

Type.—Adult male, collected on Bunguran Island, North Natuna Islands, on 3rd September, 1928, by F. N. Chasen.

Total length, 428 mm.; tail, 274 mm.; wing, 140 mm.; tarsus, 33 mm.; bill from gape, 39 mm.

Iris, brown, lids, blue; bill, red; feet, grey.

Specimens examined.—Seven from Bunguran.

NINE NEW RACES OF NATUNA BIRDS

Wings.—Bunguran, ♂, 140 (type); 146, —, 143, 149; ♀, 147, 140 mm.

Remarks.—We now recognise three Malaysian races of this cuckoo. The typical form has the rufous of the breast and the grey of the abdomen fairly sharply defined. *Z. j. pallidus* Rob. and Kloss¹ has the grey of the under parts paler and washed with buff, but the breast remains well defined from the grey area: the lores are less extensively rufous than in *Z. j. javanicus*. The third form is that described above. Of the seven specimens before us the female is probably not separable from *pallidus*: one of the males is also very near *pallidus* but the remaining birds, all males, have the centre of the abdomen rufous-buff and continuous with the colour of the breast. Some of them show a tendency for the rufous of the lores to be continued over the anterior part of the supercilium.

***Chalcoparia singalensis pallida* subsp. nov.**

Chalcoparia singalensis, Hart., Nov. Zool., I, 1894, p. 475 (Bunguran).

Chalcoparia singalensis borneana, Oberh., Bull. U. S. Nat. Mus., 159, 1932, p. 112 (Bunguran).

Nearest to *C. s. singalensis* of the Malay Peninsula but the male with the rufous of the under parts less intense, less sharply defined, and not so extensive.

Type.—Adult male, collected on Bunguran Island, North Natuna Islands, on 28th August 1928, by F. N. Chasen.

Total length, 112 mm.; tail, 40 mm.; wing, 53 mm.; tarsus, 17 mm.; bill from gape, 15 mm.

Iris, red; bill, black; feet, olive.

Specimens examined.—Four from Bunguran.

Wings.—♂, 53, 55, 55 mm.; ♀, 53 mm.

***Charitociris maculata natunensis* subsp. nov.**

Prionochilus maculatus, Hart., Nov. Zool., I, 1894, p. 474 (Bunguran).

Charitociris maculata maculata, Oberh., Bull. U. S. Nat. Mus., 159, 1932, p. 118 (Bunguran).

Like *C. m. maculatus* of the Malay Peninsula but the under parts brighter and yellower, and with the dark markings more olive and less grey; throat more washed with yellow.

Type.—Adult male, collected on Bunguran Island, North Natuna Islands, on 28th August 1928, by F. N. Chasen.

Total length, 94 mm.; tail, 24 mm.; wing, 51 mm.; tarsus, 13 mm.; bill from gape, 12 mm.

¹. Journ. Fed. Mal. States Mus., X, 1921, p. 203 (Kedah Peak, Malay Peninsula).

Iris, red; upper mandible, black; lower mandible, bluish grey; feet, leaden.

Specimens examined.—Three males and one female from Bunguran compared with about fifty skins of *C. m. maculata* from the Malay Peninsula.

Wings.—♂, 51, 51, 52 mm.; ♀, 51 mm.

Remarks.—The female is only doubtfully separable from an exceptionally bright female of *C. m. maculata* from the Malay State of Perak, but this latter bird is unique in the Malayan series which contains specimens taken throughout the year.

Piprisoma agile bungurense subsp. nov.

Like *P. a. sordidum* Rob. and Kloss, of the Malay Peninsula but larger.

Type.—Adult male, collected on Bunguran Island, North Natuna Islands, South China Sea, on 7th September 1928 by F. N. Chasen.

Total length, 109 mm.; tail, 32 mm.; wing, 63.5 mm.; tarsus, 13 (c) mm.; bill from gape, 11 mm.

Irides, yellow; upper mandible, dark grey; lower mandible, blue grey; feet, blackish brown.

Specimens examined.—One (the type). Compared with three examples of *P. a. sordidum* from the Malay Peninsula and Bintang Island in the Rhio Archipelago, and eleven examples of *P. a. everetti* from Sarawak.

Remarks.—The wings of the four known specimens of *sordidum* measure 59, 60, 60 and 60 mm. and the wings of a small series of *everetti*, 56, 57, 58, 59, 59 and 60 mm. The single example of *sordidum* available for comparison (recorded in Journ. Mal. Br. Roy. Asiat. Soc., III, 1925, p. 102) differs from the *everetti* series in being generally rather greyer and less brown both above and below, but the two forms are very close. The Natuna bird and two recent skins from Bintang Island are alike and compared with *sordidum* are darker above and below: they differ from *everetti* (all old skins) in having the upper parts darker, and the lower parts greyer and less brown and more heavily streaked. It is probable that these colour differences depend, largely, on the age of the skin and fresh skins of *everetti* are needed for comparison.

Zosterops palpebrosa erwini subsp. nov.

Nearest to *Z. p. williamsoni* Rob. and Kl., of Siam and the Malay Peninsula but the yellow parts rather paler, less brightly golden and more greenish. The under parts faintly shaded with grey, especially on the flanks, and never with cream or buff. Bill usually larger than in *williamsoni*.

NINE NEW RACES OF NATUNA BIRDS

Type.—Adult female, collected on Pulau Panjang, South Natuna Islands, South China Sea, on 9th August 1931 by P. M. de Fontaine.

“Irides, hazel; bill, brown, blue at the base of the lower mandible; feet, greenish blue.”

Specimens examined.—Thirteen from the island of Panjang and the neighbouring islet of Kordu.

Wings.—♂, 51, 52, 52, 52, 52, 53, 53, 53; ♀, 50, 50, 52, 53 mm.

Remarks.—The females average slightly paler on the throat than the males. The genus *Zosterops* has not hitherto been recorded from the Natuna Islands. This new form is named in honour of Dr. Erwin Stresemann.

***Aethopyga siparaja natunæ* subsp. nov.**

Aethopyga siparaja, Hart., Nov. Zool., I, 1894, p. 475 (Bunguran); II, 1895, p. 469 (Bunguran and Pulau Laut).

Aethopyga siparaja ochropyrrha, Oberh., 1932, p. 117 (Bunguran and Pulau Laut).

Like *A. s. siparaja* but the grey under parts paler.

Type.—Adult male collected on Sadanau Island, North Natuna Islands, on 21st September, 1928 by F. N. Chasen.

Total length, 110; tail, 41; wing, 50; tarsus, 13; bill from gape, 17 mm.

Specimens examined.—Twelve males and two females from Bunguran and Sedanau Islands.

“Iris, bill and feet, dark brown.”

Wings.—♂, 51, 51, 52, 50, 50, 49, 49, 51, 52, 52, 50 mm.; ♀, 46, 46 mm.

Remarks.—The grey under parts of *A. s. siparaja* are very variable but the Natuna series of twelve beautiful adult males is very different from that obtained in the Anamba Islands, the Malay Peninsula and elsewhere.

In typical *siparaja* the dark grey under parts almost invariably have an olive wash, although the extent of this varies greatly: there is also a conspicuous darkening of the grey, often as an irregular patch, next to the red breast.

In the Natuna series five specimens are very pale below, with little if any olive wash and without the slightest indication of a dark patch. They are in fact just like *A. s. cura* on the under parts and can be picked out at once from a series of more than fifty fully adult males of *siparaja*. In the remainder of the Natuna series the black patch is much reduced, but one or two birds are not separable from pale examples of *siparaja*. It is interesting to note that there is no tendency to enlargement of the bill in this form.

Three New Malaysian Mammals

By F. N. CHASEN

Rattus mülleri otiosus subsp. nov.

Rattus mülleri subsp., Bull. Raffles Mus., 6, 1931, pp. 37 and 71 (measurements).

Characters. Like *R. m. borneanus* (Miller), on the mainland of Borneo but with a shorter tail.

Type.—Adult male (skin and skull), collected on Balambangan Island, North Borneo, on 11th September, 1927, by C. Boden Kloss and F. N. Chasen. Raffles Museum No. 3487.

External measurements.—Head and body, 230; tail, 250; hind-foot, (s.u.), 42; ear, 22 mm.

Skull.—Greatest length, 52.6; condylo-basilar length, 45.3; diastema, 15.1; upper molar row (alveoli), 9; length of palatal foramina, 8.1; median nasal length, 21.5; breadth of combined nasals, 6.5; zygomatic breadth, 26 mm.

Specimens examined.—Banguey Island, North Borneo, 5 ♂, 6 ♀; Balambangan Island, 3 ♂, 2 ♀.

Remarks.—In the absence of topotypes of *R. m. integer* (Miller), from the South Natuna Islands, Mr. Kloss and I once had to leave these rats from the North Bornean Islands without a subspecific name, but I now see that *integer* is a duller rat with a tail measuring only 225–231 mm. in length. *R. m. otiosus* has the tail in large adults measuring 240–282 mm. The specimens on which this new race is based, together with a series of *R. m. borneanus*, are described in greater detail in an earlier number of this journal (*l.c.s.*).

Tragulus kanchil klossi subsp. nov.

Tragulus kanchil longipes, Chas. and Kloss, Bull. Raffles Mus., 6, 1931, pp. 17 and 55 (measurements).

Characters.—Like *T. k. hosei* Bonh., of Sarawak but generally paler and duller.

Type.—Adult male (skin and skull), collected at Bettotan, near Sandakan, British North Borneo, on 15th August 1927, by C. Boden Kloss and F. N. Chasen. Raffles Museum No. 3273.

External measurements.—Head and body, 478; tail, 72; hind-foot and hoof, 130 mm.

Skull.—Condylo-basal length, 92; palatal length, 53; diastema, 9.5; upper molar row, 33.8; median nasal length, 30; inter-orbital breadth, 27; zygomatic breadth, 44.5 mm.

THREE NEW MALAYSIAN MAMMALS

Remarks.—The nine examples on which this new race is founded were once referred to *T. k. longipes* described by Lyon from the lowlands of Eastern Sumatra and later considered by that author to occur also in West, South-west, and South-east Borneo, but I have recently seen a skin of the lesser mouse-deer from near Pontianak, West Borneo and it is exactly like topotypes of *T. k. hosci*. Details of the specimens are given in the reference quoted above.

***Lariscus insignis saturatus* subsp. nov.**

Characters.—A brightly coloured race, nearest to *L. i. castaneus* (Miller), of the Anamba Islands, but the black dorsal stripes are narrower, the crown darker, the muzzle greyer and less golden, and the feet, especially the fore-feet, darker (blackened). Resembles *castaneus* in that the back between the dorsal stripes is much greyer and less chestnut than the sides of the body, thereby forming a sharp contrast. Hairs of the tail tipped with white.

Type.—Adult female (skin and skull), collected on Bintang Island, Rhio Archipelago, on 2nd June 1930 by a native collector. Raffles Museum No. 2820.

Skull.—Resembles that of *L. i. castaneus*.

Specimens examined.—One male and three females, including the type.

Measurements.—See table below.

Remarks.—Variation in the small series is not very noticeable. The male has the hind-feet rather brighter than in the three females and in this one respect is not separable from *castaneus*. The Bintang race needs no detailed comparison with typical *insignis* of Sumatra which has the under parts much washed with rufous, or the much brighter *diversus* of Borneo in which the flanks are almost clear red. *Meridionalis* of Singapore Island, and *fornicatus* of Pulau Tioman are rather duller: furthermore, the area between the dorsal stripes is similar in colour to the flanks and both have the tail hairs tipped with ochraceous, not white.

This is the first time *Lariscus* has been definitely recorded from the Rhio Archipelago.

Species & Locality	Sex	SKULL						Remarks
		Frontal length	Postorbital length	Interorbital width	Zygomatic breadth	Number		
<i>Lariuscus insignis</i>								
<i>saturatus</i>								
Bintang Island	♂			
"	♀	200	115	45	...	51.2	...	
"	♀	49.8	41.3	
"	♀	52.8	44.3	

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